Refine Search

Search Results -

Terms	Documents
707/204	3781

Database:
US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
JPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search:

Refine Search

Recall Text Clear Interrupt

Search History

DATE: Wednesday, June 27, 2007 **Purge Queries** Printable Copy Create Case

Set Name side by side	**Query**	**Hit Count**	**Set Name** result set
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR		
L45	707/204	3781	L45
L44	707/203	4121	L44
L43	707/202	2897	L43
L42	707/201	3961	L42
L41	707/104.1	8620	L41
L40	707/101	6327	L40
L39	707/102	10104	L39
L38	707/2	6515	L38
L37	707/5	5125	L37
L36	707/4	5895	L36
L35	707/9	3721	L35
	DB=USPT; PLUR=YES; OP=OR		
L34	("5778368")[URPN]	188	L34

L33	(5640446 | 5546455 | 5446842 | 4805134 | 5377259 | 5483652 | 5553282 | 5313614 | 5457305 | 5596632 | 5022028 | 5257369 | 5421009 | 5659735)![PN]	14	L33
L32	("5778368")[PN]	1	L32
L31	("6484161")[URPN]	5	L31
L30	(5956716 | 6253248 | 6061515)![PN]	3	L30
L29	("6484161")[PN]	1	L29
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR		
L28	L27 and (search with agent or search near agent or search adj agent)	43	L28
L27	L23 and (distributed or distribut$) and computer with system	2182	L27
L26	L25 and (search with agent or search near agent or search adj agent)	17	L26
L25	L24 and 707/10	467	L25
L24	L23 and (distributed or distribut$) and (database or data with base)	2199	L24
L23	l5 not @py>1999	5386	L23
	DB=USPT; PLUR=YES; OP=OR		
L22	("6108686")[URPN]	38	L22
L21	(5855015 | 5722041 | 5920856 | 6029165 | 5983218 | 6009422 | 5974441 | 5819273 | 5983200)![PN]	9	L21
L20	("6108686")[PN]	1	L20
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR		
L19	5778368.pn.	2	L19
L18	6484161.pn.	2	L18
L17	6108686.pn.	2	L17
L16	726/12	121	L16
L15	705/1	7261	L15
L14	709/227	8239	L14
L13	709/218	5909	L13
L12	709/217	10952	L12
L11	705/27	3730	L11
L10	705/26	7626	L10
L9	707/9	3721	L9
L8	726.clas.	11555	L8
L7	709.clas.	55296	L7
L6	705.clas.	51403	L6
L5	707.clas.	44458	L5
L4	707/100	10344	L4
L3	707/10	15103	L3
L2	707/3	10806	L2
L1	707/1	9703	L1

END OF SEARCH HISTORY

Refine Search

Search Results -

Terms	Documents
L20 and 707/3	8

Database:

US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
JPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search:

Refine Search

Recall Text Clear Interrupt

Search History

DATE: Wednesday, June 27, 2007 Purge Queries Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
	DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR		
L22	l20 and 707/3	8	L22
L21	l20 and 707/10	12	L21
L20	L18 not @py>1999	68	L20
L19	L18 not@>py1999	39562867	L19
L18	L17 and (remote or second or secondary) near (database or data with base)	875	L18
L17	L16 and (distributed or distribut$) with system	5550	L17
L16	(database or data with base) near search	24485	L16
L15	"gaulin, mark".in.	0	L15
L14	"schneiter, john".in.	27	L14
L13	"schneiter, andrea".in.	0	L13
L12	"globalspec incorporated".as.	0	L12
	DB=PGPB; PLUR=YES; OP=OR		

L11	l4 and L10	53	L11
L10	726.clas.	6913	L10
L9	l4 and l8	374	L9
L8	709.clas.	28561	L8
L7	l4 and L6	552	L7
L6	705.clas.	34636	L6
L5	l1 and L4	573	L5
L4	L3 and (search with agent or search near agent or search adj agent) and (database or data with base)	2666	L4
L3	(distributed or distribut$) and computer system	1069845	L3
L2	L1 and (distributed or distribut$) and computer system	1059751	L2
L1	707.clas.	23757	L1

END OF SEARCH HISTORY

Home | Login | Logout | Access Information | Alerts |

Welcome United States Patent and Trademark Office

Search Results

BROWSE SEARCH IEEE XPLORE GUIDE

Results for **"(bharat bhargava<in>au)"**
Your search matched **3** of **1595071** documents.
A maximum of **100** results are displayed, **25** to a page, sorted by **Relevance** in **Descending** order.

e-mail

» Search Options

View Session History

New Search

Modify Search

(bharat bhargava<in>au) Search

Check to search only within this results set

Display Format: Citation Citation & Abstract

» Key

IEEE JNL	IEEE Journal or Magazine
IET JNL	IET Journal or Magazine
IEEE CNF	IEEE Conference Proceeding
IET CNF	IET Conference Proceeding
IEEE STD	IEEE Standard

view selected items **Select All** **Deselect All**

1. **On the Design of Perceptual MPEG-Video Encryption Algorithms**
Shujun Li; Guanrong Chen; Cheung, A.; Bharat Bhargava; Bhargava, B.;
Circuits and Systems for Video Technology, IEEE Transactions on
Volume 17, Issue 2, Feb. 2007 Page(s):214 - 223
Digital Object Identifier 10.1109/TCSVT.2006.888840
AbstractPlus | Full Text: PDF(928 KB) IEEE JNL
Rights and Permissions

2. **A tree-based forward digest protocol to verify data integrity in distributed streaming**
Habib, A.; Xu, D.; Atallah, M.; Bharat Bhargava; Chuang, J.;
Knowledge and Data Engineering, IEEE Transactions on
Volume 17, Issue 7, July 2005 Page(s):1010 - 1014
Digital Object Identifier 10.1109/TKDE.2005.102
AbstractPlus | Full Text: PDF(336 KB) IEEE JNL
Rights and Permissions

3. **Peer-to-peer file-sharing over mobile ad hoc networks**
Ding, G.; Bharat Bhargava;
Pervasive Computing and Communications Workshops, 2004. Proceedings of Annual Conference on
14-17 March 2004 Page(s):104 - 108
Digital Object Identifier 10.1109/PERCOMW.2004.1276914
AbstractPlus | Full Text: PDF(262 KB) IEEE CNF
Rights and Permissions

Help Contact Us Privacy & .

Results for **"(heterogeneous mobile databases<in>metadata)"**

e-mail

Your search matched **1** of **1595071** documents.

A maximum of **100** results are displayed, **25** to a page, sorted by **Relevance** in **Descending** order.

» Search Options

View Session History

New Search

Modify Search

(heterogeneous mobile databases<in>metadata) Search

☐ Check to search only within this results set

Display Format: ◉ Citation ○ Citation & Abstract

» Key

IEEE JNL	IEEE Journal or Magazine
IET JNL	IET Journal or Magazine
IEEE CNF	IEEE Conference Proceeding
IET CNF	IET Conference Proceeding
IEEE STD	IEEE Standard

view selected items **Select All** **Deselect All**

☐ **1. Real-time processing of range-monitoring queries in heterogeneous mob**
Ying Cai; Hua, K.A.; Guohong Cao; Xu, T.;
Mobile Computing, IEEE Transactions on
Volume 5, Issue 7, July 2006 Page(s):931 - 942
Digital Object Identifier 10.1109/TMC.2006.105
AbstractPlus | Full Text: PDF(1960 KB) IEEE JNL
Rights and Permissions

Anonymity in a Mobile Computing Environment

N. Asokan
Department of Computer Science
University of Waterloo
Waterloo, Ont. N2L 3G1, Canada
nasokan@uwaterloo.ca

Abstract

In a mobile computing environment, it is desirable to protect information about the movements and activities of mobile entities from onlookers. Solutions to this problem of providing anonymity have to be developed with the constraints of mobile computing environments in mind. In this paper, it is argued that this issue merits investigation. A brief survey of the nature of anonymity provided in proposed or existing mobile computing environments is presented. It is argued further that achieving limited but practical anonymity using standard cryptographic techniques is feasible. Example solutions are presented.

1 Introduction to the Problem

In a distributed system where some entities (i.e. users and computing devices) are mobile, it is often desirable to keep information about their movements, locations and activities confidential. The modalities of providing such *anonymity* depend on the underlying security infrastructure of the system. Typically, this infrastructure is built using a shared key cryptosystem (SKCS), a public key cryptosystem (PKCS) or a hybrid system.

Anonymity has two aspects [4]. *Anonymity of location* deals with keeping an entity's movements and whereabouts confidential. *Anonymity of data origin/destination* deals with keeping an entity's activities confidential. The latter seeks to prevent an onlooker from associating the entity with messages sent to/from it or with the sessions in which it is a participant. Within the context of this paper, anonymity as a goal does not imply unrestrained anonymity; it implies the protection of relevant information from *unintended* parties. For example, I assume that a server may demand that a potential client reveal its true identity and perhaps provide adequate authentication as a prerequisite to the use of services.

In traditional computing environments, with fixed entities and wireline networks, anonymity of location has not been considered a significant issue. In a mobile computing environment, it assumes greater importance. It is likely to be an important security problem to solve before mobile computing gains wide acceptance. Anonymity is especially desirable when an entity travels outside of its 'home domain.'[1] In spite of that, it has not been considered a basic requirement in designing protocols for mobile computing environments (e.g. the IETF mobile-IP effort [12] has not yet addressed this issue). Like every other aspect of security, provision of anonymity is tightly coupled with the architecture of the rest of the system. For instance, providing anonymity of network layer identity will be of little use if the routing protocol uses re-direction: an onlooker who has access to a router elsewhere on the system can determine the whereabouts of a mobile entity by trying to send a message to it. Therefore, the problem of providing anonymity should be considered during the design stage of building mobile computing environments.

There are philosophical motivations for providing anonymity as well. An entity that chooses to protect its location and activities from unintended third parties must have the mechanisms available to do so even if openness and full disclosure is a common policy. Besides, the principle of least information is a good rule to live by in designing security systems.

The rest of this document describes some proposed solutions to the anonymity problem and makes suggestions for improving them. The basic theme behind the suggestions is that effective anonymity can be achieved by making a *limited disclosure* of information.

[1] A *domain* consists of entities that fall within a common administrative control.

0-8186-6345-6/95 $04.00 © 1995 IEEE

2 Solutions

Notation
X_K - A message X encrypted/sealed by a key K.
K_{AB} - A secret key shared between parties A, B.
K_A, K_A^{-1} - Public and private key pair of A.
N_A - A *nonce* created by A.
M - Mobile entity.
R - Remote domain M is visiting.
H - M's home domain.
D - M's current domain. (H or some R)

2.1 Shared Key Cryptosystems

In a distributed system with a security infrastructure based on a SKCS, an entity (the 'client') authenticates itself to another entity (the 'server') by demonstrating the possession of a secret key shared between them. To do this, the client has to first announce its (claimed) identity in the clear. This makes it hard to provide anonymity of location.

An intuitive solution is to use the notion of *nicknames*. Molva et. al. [11] suggest that a mobile entity could use a *traveling alias* when it travels in foreign domains. Only the mobile entity and its home domain will know the mapping between the traveling alias M_t and the real identity M. They go on to suggest that M_t be changed "at regular intervals; perhaps as often as passwords or PINs." However, in the absence of a protocol to change traveling aliases over an insecure channel, entities can change traveling aliases only when they return to their home domain. Such traveling aliases with fairly long lifetimes may be problematic in certain circumstances. For example, as mentioned before, the mobile entity may be called upon to reveal (and even prove) its real identity M before being granted certain services in foreign domains. With time, the set of entities that know the mapping between M_t and M will grow. Further, an onlooker will be able to use a long lived alias M_t to link the various activities of M for the period during which the alias remains in effect.

An alternative is to use short-lived aliases [8]. Aliases are changed by mutual agreement between the mobile entity and its home domain server. This implies that the mobile and the home domain stay synchronized. If synchronization is lost, a sub-protocol is necessary for re-synchronization. Achieving resynchronization securely is a challenge. In [8] the mobile entity may be required to send its identity in the clear in order to achieve resynchronization. This, as observed in the same document, constitutes a "breach in the provision of the service."

Loss of synchronization is likely to be rare. In addition, the home domain is likely to have significant computing resources at its disposal. Therefore, in the event of loss of synchronization, I suggest that it may be reasonable to expect the mobile M to simply send a message to H encrypted with K_{HM}. H can then search through its database of shared secret keys until it finds one that can extract the message. If the number of entities in H's jurisdiction renders this an expensive operation, then I suggest that H can divide the principals into groups of manageable sizes, each with a unique group identifier. When synchronization is lost, M can send an encrypted message along with its group identifier. This way, a reduced level of anonymity can be provided by making a *limited disclosure* of information.

Preserving anonymity of data origin is similar to preserving anonymity of location. Anonymity of data destination is somewhat different when the destination is a mobile entity. Carlsen's solution [4] suggests essentially (see below for a clarification) the following: a domain server D that wants to send a message to a mobile M currently present in its domain, will multicast a message $\{M, K_s\}_{K_{DM}}$ to all the mobile entities currently present in the domain. Each mobile will attempt to decrypt every such multicast message. Only M will be able to recover the message and the session key K_s which can be used to secure the subsequent session. Carlsen argues that in a portable (voice) communication system, such a computing load on mobile entities is reasonable assuming 3 calls per hour. The arguments may not be applicable in a data communication system where the frequency of messages to a mobile entity can be potentially much higher. Carlsen's model actually consists of various *ports* (or base stations in more common parlance). Each port serves a number of mobile entities that happen to be inside its region. Thus, it is a port which attempts to send a message to a mobile M without revealing M's identity to an onlooker. The description here is conceptually similar to Carlsen's solution.

2.2 Public Key Cryptosystems

Public key cryptosystems can provide location and data origin anonymity in a natural way. The mobile M can use the domain server D's public key K_D to encrypt messages to it. Within an administrative domain, each M can be required to know the public key K_H of its home domain server. However, when M wanders into a different domain R, it cannot be expected to know the public key, K_R. It has to identify itself first so that R can determine how to *mutually* authenticate M. The decrypt-on-the-fly solution

by Carlsen [4] to provide anonymity of data destination (as described in the previous section) will be prohibitively expensive in the case of a PKCS.

Some researchers [7][9] have discouraged the use of a PKCS to build authentication protocols for environments with mobile entities. The rationale for this recommendation is that the computational complexity of known PKCSs are beyond the limited resources available to mobile entities. Even if this argument is valid for a specific environment, it is likely to be a temporary limitation. What is more relevant is the *asymmetry* in available resources between mobile entities and their stationary counterparts. Beller et. al. observe [2] that it is feasible to design practical authentication mechanisms using PKCSs keeping this asymmetry in mind.

2.3 A Hybrid Solution

Complete anonymity may be hard to achieve. But it might also not be an absolute requirement. The earlier notion of *limited disclosure* can again be used to achieve practical anonymity. For instance, it might be acceptable to reveal that the visiting mobile entity is from domain H (or a suitably large super-domain of H), without revealing its exact identity. A hybrid protocol can provide such limited anonymity without being too complicated. In the rest of this section I describe an example protocol for authenticating a mobile entity using the above notion of limited disclosure.

Consider the following model: the system is partitioned into domains. The authentication server in domain H shares a secret key with every entity in the domain. H's public key is known to every entity in its domain. Each pair of domains H and R have (or using an inter-domain key distribution protocol, can dynamically arrange to have) a shared key K_{HR}.[2] The remote server R will provide services to the visiting mobile M only if *(a)* M's true identity is revealed to it and *(b)* the authenticity of the claimed identity is adequately demonstrated. Finally, all network links are considered to be insecure channels in which an intruder can observe, modify or destroy data. The goal is to achieve satisfactory mutual authentication between M and R while minimizing the set of entities that can infer the presence of M in R by watching the traffic.

The authentication protocol works as follows:

When a mobile M shows up in a remote domain R, it begins the registration process by identifying its home domain H and presenting its credentials encrypted with the public key of H. I assume that M can compute the key K_{MR} which is to be used for the mutual authentication. I elaborate on the computation of K_{MR} below. The first message is sent from the M to R as follows:

M1: $M \Rightarrow R : Cred_{MR},\ H,\ \{M, R, N_M\}_{K_{MR}}$

Where,

$Cred_{MR} = \{M, R, H, \{T_M\}_{K_{MH}}\}_{K_H}$

T_M is either a time stamp (which will imply the need for loosely synchronized clocks) or some indicator of freshness (e.g. a nonce that was handed to M the last time it authenticated successfully to H). In this description, I will assume that T_M is the current timestamp. R cannot verify the credentials. It can however find and mutually authenticate H and pass the credentials to it. The second message is from R to H as follows:

M2: $R \Rightarrow H : \{R, Cred_{MR}, N_R\}_{K_{HR}}$, R

H can verify the veracity and timeliness of the message from M. If the verification succeeds, H has to send the necessary information back to complete mutual authentication between M and R. The exact nature of this information depends on the assumptions made. For example, if T_M is a nonce and not a timestamp, H has to generate a new nonce to be sent back to M so that it can be used in the next protocol run. H also needs to inform R (and perhaps M) of the key K_{MR} that is to be used to secure the channel between M and R. H can pick a random key K_{MR} to be used by M and R. Or K_{MR} can be derived from other information that is unique to a given protocol run. For example, K_{MR} can be a one-way hash function $h(K_{MH}, R, T_M)$. In this case, M already possesses enough information to compute K_{MR} when it initiates the protocol. I use the latter. This is why I stated that M can compute K_{MR} and use it to encrypt the second part of the message $M1$. The third message is from H to R as follows:

M3: $H \Rightarrow R : Tick_{HR}$

Where,

$Tick_{HR} = \{R, H, M, K_{MR}, N_R\}_{K_{HR}}$

R can now know the true identity of M. It can also extract the key K_{MR} using which it can extract

[2] Designing a scalable key distribution mechanism is another security problem that has been made more urgent by the advent of mobile computing. While there have been proposals to solve this problem by imposing a hierarchy of trust, such a hierarchy is not acceptable in all situations. This remains an open issue.

the second part of message $M1$. It can use these to complete the mutual authentication with M as follows:

M4: $R \Rightarrow M : \{N_R', N_M, M, R\}_{K_{MR}}$

M can use the already computed K_{MR} to extract this message. It can verify that this response is timely by checking for the presence of its nonce N_M inside. It can then respond to the challenge by demonstrating to R that it was able to extract the nonce N_R'.

M5: $M \Rightarrow R : \{M, R, N_R'\}_{K_{MR}}$

Several variations to this example protocol are possible. For example, in message $M5$, R can allocate a temporary identifier to M as in [11] to be used in subsequent messages from and to M while it is in R. The same K_{MR} is expected to be used for mutual authentication between M and R for subsequent connection attempts for the entire duration of M's stay in R. But R or M can force a re-authentication involving H at any time, should they feel the need to do so.

This protocol provides limited anonymity since an onlooker can only know that an entity from H visited R but cannot determine the exact identity of the entity. It is scalable in that it can provide anonymity to an arbitrary level of granularity: instead of specifying H, M could have identified some parent domain H' of H and used $K_{H'}$ to encode its identity relative to H'. While H' shares no secret with M and therefore cannot verify the authenticity directly, it can form a trusted path to H and pass along the credentials. This protocol also takes the asymmetry of computing power into account: the mobile entities transfer the burden of verifying authenticity to their home domains. Even if the inter-domain key distribution protocol was based on a PKCS, the expensive task of verifying a chain of certificates provided by R will fall on H and not on M. There is only one public key operation (encryption using H's public key) that M has to perform. In general, the public key operations of a PKCS are less expensive than the private key operations. M has to store a small, finite number of keys in its permanent storage(e.g. K_{MH} and K_H). It also needs to store K_{MR} (or enough information to re-compute K_{MR}) for the duration of its stay in R.

A correctness proof of this protocol using the BAN logic [3] appears in [1]. However, the proof only establishes that the authentication protocol is correct. In future work, I hope to investigate how the analysis techniques can be used to draw formal conclusions about the preservation of anonymity.

3 Related Work

A referee pointed me to the work done by David Chaum. Chaum and others have done extensive work on unconditionally anonymous protocols to implement, among other things, the digital equivalent of cash. The basic theme of security (for providing and/or using services and products) without identification is expounded by Chaum in [6]. By requiring that the security of a transaction not be dependent on establishing the identities of participants to one another, it is possible to design protocols that achieve complete unconditional anonymity. Unconditional anonymity also opens the possibility of "perfect crime" (See [13], page 123, for a reference). Chaum uses the phrase "limited anonymity" in [5] to denote the anonymity provided by a special set of protocols. These protocols, like the unconditional anonymity protocols, preserve the anonymity of participants from onlookers and from each other. However, if necessary (for example, by a court warrant), the anonymity of a transaction can be undone at a later time.

In this paper, I assume that the legitimate parties involved in a transaction can demand to know the real identities of the other parties. The concern here is to protect the identities of certain parties involved in the transaction from other onlookers who are not legitimate parties to the transaction. By "limited anonymity" I mean that some information about the identity of a participant is leaked to an eavesdropping third party.

The ideas presented here are intuitive. Similar ideas have been used in different contexts. In [10], Maxemchuk et. al. describe various protocols for providing anonymity using a building block called "Double Locked Box Protocol." Using this protocol, an entity A can send a message to another entity B via an intermediary I. A starts by sealing the identity of B in a box that only B's computer can open. This box is placed inside another box, along with the identity of B's computer and sealed so that only the intermediary I can open the outer box. The box is then handed to A's computer. A's computer cannot see what is inside but knows that it needs to be passed to I. I can get no information about the sender or recipient except the identities of their computers. B's computer, which receives the inner box from I knows nothing about the sender. As is evident, the basic idea is that by disclosing a limited amount of information in the clear, significant anonymity can be obtained.

4 Conclusion

Anonymity has not been a major issue in traditional distributed systems like the Internet. But the advent of mobile computing has provided strong motivations to address this problem. Providing complete anonymity is often hard, infeasible or undesirable. This document has made suggestions that can help provide limited but practical anonymity by using *limited disclosure* of information. Provision of anonymity, and security issues in general, must be taken into account while mobile computing environments are being designed.

5 Acknowledgements

I would like to thank Jay Black, James Godfrey, Anil Goel and Leena Tirkkonen for their careful reading of earlier versions of this paper and for their valuable comments and suggestions. Robyn Landers helped improve the quality of presentation.

References

[1] N. Asokan. Security Issues in Mobile Computing. Unpublished manuscript, October 1994.

[2] Michael Beller et al. Privacy and Authentication on a Portable Communications System. *IEEE JSAC*, 11(6):821–829, August 1993.

[3] Michael Burrows et al. A Logic of Authentication. Technical Report 39, Digital Systems Research Center, February 1989. Revised February, 1990; Appendix(The Scope of a Logic of Authentication) May, 1994.

[4] Ulf Carlsen. Optimal Privacy and Authentication on a Portable Communication System. *Operating Systems Review*, 28(3):16–23, July 1994.

[5] David Chaum. Untraceable Electronic Mail, Return Addresses and Digital Pseudonyms. *CACM*, 24(2):84–88, February 1981.

[6] David Chaum. Security Without Identification: Transaction Systems to Make Big Brother Obsolete. *CACM*, 28(10):1030–1044, October 1985.

[7] ETSI. DECT Common Interface: Part 7 - Security Issues. ETSI Standard ETS 300 175.7, European Telecommunications Standards Institute, October 1992.

[8] ETSI. GSM - Security Related Network Functions. ETSI Standard GSM 03.20, European Telecommunications Standards Institute, October 1993.

[9] Y. Frankel et al. Fraud Prevention and Availability. Manuscript available in ftp://software.watson.ibm.com/pub/security/cdpd, October 1994.

[10] N. F. Maxemchuck and S. Low. The Use of Communications Networks to Increase Personal Privacy. Available from ftp://ftp.research.att.com/dist/anoncc, August 1994.

[11] Refik Molva et al. Authentication of Mobile Users. *IEEE Network*, 8(2):26–34, March/April 1994.

[12] C. Perkins. IP Mobility Support. Internet Draft 07, IETF Network Working Group, October 1994.

[13] Bruce Schneier. *Applied Cryptography*. John Wiley & Sons, first edition, 1994.

Anonymity in a mobile computing environment

Asokan, N.
Dept. of Comput. Sci., Waterloo Univ., Ont., Canada;

This paper appears in: Mobile Computing Systems and Applications, 1994. Proceedi
Publication Date: 8-9 Dec. 1994
On page(s): 200 - 204
Meeting Date: 12/08/1994 - 12/09/1994
Location: Santa Cruz, CA
INSPEC Accession Number:4924006
Digital Object Identifier: 10.1109/MCSA.1994.513484
Posted online: 2002-08-06 19:18:02.0

Abstract
In a **mobile computing** environment, it is desirable to protect information about the mov
of mobile entities from onlookers. Solutions to this problem of providing anonymity have t
the constraints of **mobile computing** environments in mind. It is argued that this issue m
brief survey of the nature of anonymity provided in proposed or existing **mobile computi**
presented. It is argued further that achieving limited but practical anonymity using standa
techniques is feasible. Example solutions are presented

Index Terms
Inspec
Controlled Indexing
cryptography data privacy mobile communication telecommunication comput

Non-controlled Indexing
anonymity **mobile computing** environment mobile entities standard cryptogr
techniques
Author Keywords
Not Available

References

No references available on IEEE Xplore.

Citing Documents

No citing documents available on IEEE Xplore.

Home | Login | Logout | Access Information | Alerts |

Welcome United States Patent and Trademark Office

☐ Search Results

BROWSE SEARCH IEEE XPLORE GUIDE

Results for "**(mobile computing<in>metadata)**"
Your search matched **7470** of **1595071** documents.
A maximum of **100** results are displayed, **25** to a page, sorted by **Relevance** in **Descending** order.

e-mail

» Search Options

View Session History

New Search

» Key

IEEE JNL	IEEE Journal or Magazine
IET JNL	IET Journal or Magazine
IEEE CNF	IEEE Conference Proceeding
IET CNF	IET Conference Proceeding
IEEE STD	IEEE Standard

Modify Search

(mobile computing<in>metadata) Search

☐ Check to search only within this results set

Display Format: ◉ Citation ○ Citation & Abstract

view selected items **Select All** **Deselect All** **View: 1-25** | 26-5

☐ 1. **Query processing in a mobile computing environment: exploiting the feat asymmetry**
Wen-Chih Peng; Ming-Syan Chen;
Knowledge and Data Engineering, IEEE Transactions on
Volume 17, Issue 7, July 2005 Page(s):982 - 996
Digital Object Identifier 10.1109/TKDE.2005.115
AbstractPlus | Full Text: PDF(1056 KB) **IEEE JNL**
Rights and Permissions

☐ 2. **MOBICHARTS: a notation to specify mobile computing applications**
Acharya, S.; Mohanty, H.; Shyamasundar, R.K.;
System Sciences, 2003. Proceedings of the 36th Annual Hawaii International (
6-9 Jan 2003 Page(s):11 pp.
Digital Object Identifier 10.1109/HICSS.2003.1174844
AbstractPlus | Full Text: PDF(406 KB) **IEEE CNF**
Rights and Permissions

☐ 3. **A Brief Review on Application of Mobile Computing in Construction**
Wanhong Zou; Xiuzi Ye; Wei Peng; Zhiyang Chen;
Computer and Computational Sciences, 2006. IMSCCS '06. First International Symposiums on
Volume 2, 20-24 April 2006 Page(s):657 - 661
Digital Object Identifier 10.1109/IMSCCS.2006.141
AbstractPlus | Full Text: PDF(216 KB) **IEEE CNF**
Rights and Permissions

☐ 4. **Experience in teaching a graduate course in mobile computing**
Gupta, S.K.S.; Srimani, P.K.;
Frontiers in Education Conference, 2000. FIE 2000. 30th Annual
Volume 2, 18-21 Oct. 2000 Page(s):S1C/6 - S1C11 vol.2
Digital Object Identifier 10.1109/FIE.2000.896614
AbstractPlus | Full Text: PDF(612 KB) **IEEE CNF**
Rights and Permissions

☐ 5. **Design and performance studies of an adaptive cache retrieval scheme ir computing environment**
Wen-Chih Peng; Ming-Syan Chen;
Mobile Computing, IEEE Transactions on

Volume 4, Issue 1, Jan-Feb 2005 Page(s):29 - 40
Digital Object Identifier 10.1109/TMC.2005.9(410) 4

AbstractPlus | Full Text: PDF(1168 KB) **IEEE JNL**
Rights and Permissions

6. **Mobichart for modeling mobile computing tasks**
Mohanty, H.; Acharya, S.; Shyamasundar, R.K.; Ghosh, R.K.;
TENCON 2003. Conference on Convergent Technologies for Asia-Pacific Regi
Volume 1, 15-17 Oct. 2003 Page(s):193 - 197 Vol.1
Digital Object Identifier 10.1109/TENCON.2003.1273313

AbstractPlus | Full Text: PDF(337 KB) **IEEE CNF**
Rights and Permissions

7. **Mobile agent system architecture for supporting mobile market applicati mobile computing environment**
Phyoung Jung Kim; Young Ju Noh;
Geometric Modeling and Graphics, 2003. Proceedings. 2003 International Con
16-18 July 2003 Page(s):149 - 153

AbstractPlus | Full Text: PDF(321 KB) **IEEE CNF**
Rights and Permissions

8. **Design of MOBILE MOM: Message oriented middleware service for mobil**
Do-Guen Jung; Kwang-Jin Paek; Tai-Yun Kim;
Parallel Processing, 1999. Proceedings. 1999 International Workshops on
21-24 Sept. 1999 Page(s):434 - 439
Digital Object Identifier 10.1109/ICPPW.1999.800097

AbstractPlus | Full Text: PDF(196 KB) **IEEE CNF**
Rights and Permissions

9. **Design and Performance Studies of an Adaptive Scheme for Serving Dyn Content in a Mobile Computing Environment**
Zhigang Hua; Xing Xie; Hao Liu; Hanqing Lu; Wei-Ying Ma;
Mobile Computing, IEEE Transactions on
Volume 5, Issue 12, Dec. 2006 Page(s):1650 - 1662
Digital Object Identifier 10.1109/TMC.2006.182

AbstractPlus | Full Text: PDF(2644 KB) **IEEE JNL**
Rights and Permissions

10. **Mobile computing**
Satyanarayanan, M.;
Computer
Volume 26, Issue 9, Sept. 1993 Page(s):81 - 82
Digital Object Identifier 10.1109/2.231283

AbstractPlus | Full Text: PDF(228 KB) **IEEE JNL**
Rights and Permissions

11. **Shared data allocation in a mobile computing system: exploring local an optimization**
Wen-Chih Peng; Ming-Syan Chen;
Parallel and Distributed Systems, IEEE Transactions on
Volume 16, Issue 4, April 2005 Page(s):374 - 384
Digital Object Identifier 10.1109/TPDS.2005.50

AbstractPlus | Full Text: PDF(1096 KB) **IEEE JNL**
Rights and Permissions

12. **AmbientTalk: Language Support for Mobile Computing**
Dedecker, J.; Cutsem, T.V.; Mostinckx, S.; De Meuter, W.; D'Hondt, T.;
Future Mobile Computing Applications, 2006. FUMCA '06. International Works Support for

Sept. 2006 Page(s):35 - 42
Digital Object Identifier 10.1109/FUMCA.2006.1

AbstractPlus | Full Text: PDF(232 KB) **IEEE CNF**
Rights and Permissions

13. **Location database clustering to achieve location management time cost mobile computing system**
Chen Jixiong; Li Guohui; Xu Huajie; Cai Xia; Yang Bing;
Wireless Communications, Networking and Mobile Computing, 2005. Proceed International Conference on
Volume 2, 23-26 Sept. 2005 Page(s):1328 - 1332
Digital Object Identifier 10.1109/WCNM.2005.1544300

AbstractPlus | Full Text: PDF(236 KB) **IEEE CNF**
Rights and Permissions

14. **Mobile commerce: vision and challenges (location and its management)**
Samaras, G.;
Applications and the Internet, 2002. (SAINT 2002). Proceedings. 2002 Sympo:
28 Jan.-1 Feb. 2002 Page(s):43 - 44
Digital Object Identifier 10.1109/SAINT.2002.994447

AbstractPlus | Full Text: PDF(226 KB) **IEEE CNF**
Rights and Permissions

15. **Nonvolatile memory requirements in a mobile computing environment**
Bickford, B.;
Nonvolatile Memory Technology Conference, 1996., Sixth Biennial IEEE Interr
24-26 June 1996 Page(s):3 - 7
Digital Object Identifier 10.1109/NVMT.1996.534660

AbstractPlus | Full Text: PDF(468 KB) **IEEE CNF**
Rights and Permissions

16. **Anonymity in a mobile computing environment**
Asokan, N.;
Mobile Computing Systems and Applications, 1994. Proceedings., Workshop (
8-9 Dec. 1994 Page(s):200 - 204
Digital Object Identifier 10.1109/MCSA.1994.513484

AbstractPlus | Full Text: PDF(380 KB) **IEEE CNF**
Rights and Permissions

17. **Applying Coordination for Service Adaptation in Mobile Computing**
Yongjie Zheng; Chan, A.T.S.; Ngai, G.;
Internet Computing, IEEE
Volume 10, Issue 5, Sept.-Oct. 2006 Page(s):61 - 67
Digital Object Identifier 10.1109/MIC.2006.93

AbstractPlus | Full Text: PDF(376 KB) **IEEE JNL**
Rights and Permissions

18. **The challenges of mobile computing**
Forman, G.H.; Zahorjan, J.;
Computer
Volume 27, Issue 4, April 1994 Page(s):38 - 47
Digital Object Identifier 10.1109/2.274999

AbstractPlus | Full Text: PDF(1904 KB) **IEEE JNL**
Rights and Permissions

19. **Mobile computing and smart spaces**
Mangione-Smith, W.H.;
Concurrency, IEEE [see also IEEE Parallel & Distributed Technology]
Volume 6, Issue 4, Oct.-Dec. 1998 Page(s):5 - 7

Digital Object Identifier 10.1109/4434.736391

AbstractPlus | Full Text: PDF(1816 KB) IEEE JNL
Rights and Permissions

20. **Mutable checkpoints: a new checkpointing approach for mobile computi**
Guohong Cao; Singhal, M.;
Parallel and Distributed Systems, IEEE Transactions on
Volume 12, Issue 2, Feb. 2001 Page(s):157 - 172
Digital Object Identifier 10.1109/71.910871

AbstractPlus | References | Full Text: PDF(276 KB) IEEE JNL
Rights and Permissions

21. **An efficient optimistic message logging scheme for recoverable mobile c systems**
Taesoon Park; Namyoon Woo; Yeom, H.Y.;
Mobile Computing, IEEE Transactions on
Volume 1, Issue 4, Oct.-Dec. 2002 Page(s):265 - 277
Digital Object Identifier 10.1109/TMC.2002.1175540

AbstractPlus | References | Full Text: PDF(1977 KB) IEEE JNL
Rights and Permissions

22. **Mobile server: an efficient mobile computing platform based on mobile a**
Wne-Bin Hu; Bo Meng;
Wireless Communications, Networking and Mobile Computing, 2005. Proceed International Conference on
Volume 2, 23-26 Sept. 2005 Page(s):1339 - 1342
Digital Object Identifier 10.1109/WCNM.2005.1544302

AbstractPlus | Full Text: PDF(190 KB) IEEE CNF
Rights and Permissions

23. **Channel adaptive resources management in wireless mobile computing : and new algorithms**
Hui Wang; Xiao-Hui Lin; Gong-Chao Su; Tian Yang; Fei Du;
Wireless Communications, Networking and Mobile Computing, 2005. Proceed International Conference on
Volume 2, 23-26 Sept. 2005 Page(s):1333 - 1338
Digital Object Identifier 10.1109/WCNM.2005.1544301

AbstractPlus | Full Text: PDF(260 KB) IEEE CNF
Rights and Permissions

24. **Mobile computing applications at Entergy**
Chaturvedi, M.;
Power Engineering Society Summer Meeting, 2001. IEEE
Volume 2, 15-19 July 2001 Page(s):1255 vol.2
Digital Object Identifier 10.1109/PESS.2001.970250

AbstractPlus | Full Text: PDF(112 KB) IEEE CNF
Rights and Permissions

25. **Formal methods for trustworthy mobile computing**
Huimin Lin;
Computer Software and Applications Conference, 2004. COMPSAC 2004. Prc 28th Annual International
2004 Page(s):500 vol.1
Digital Object Identifier 10.1109/CMPSAC.2004.1342885

AbstractPlus | Full Text: PDF(196 KB) IEEE CNF
Rights and Permissions

View: **1-25** | 26-5

Results for "(mobile computing<in>metadata)"
Your search matched **7470** of **1595071** documents.
A maximum of **100** results are displayed, **25** to a page, sorted by **Relevance** in **Descending** order.

e-mail

» **Search Options**

View Session History

New Search

» **Key**

IEEE JNL	IEEE Journal or Magazine
IET JNL	IET Journal or Magazine
IEEE CNF	IEEE Conference Proceeding
IET CNF	IET Conference Proceeding
IEEE STD	IEEE Standard

Modify Search

(mobile computing<in>metadata) Search

☐ Check to search only within this results set

Display Format: ◉ Citation ○ Citation & Abstract

view selected items **Select All** **Deselect All** View: 1-25 | **26-5**

26. An efficient authentication protocol supporting privacy in mobile comput environments
Sang Yun Park; Moon Seog Han; Young Ik Eom;
High Speed Networks and Multimedia Communications 5th IEEE International
3-5 July 2002 Page(s):332 - 334
Digital Object Identifier 10.1109/HSNMC.2002.1032602
AbstractPlus | Full Text: PDF(413 KB) **IEEE CNF**
Rights and Permissions

27. A survey of adaptive applications in mobile computing
Al-bar, A.; Wakeman, I.;
Distributed Computing Systems Workshop, 2001 International Conference on
16-19 April 2001 Page(s):246 - 251
Digital Object Identifier 10.1109/CDCS.2001.918713
AbstractPlus | Full Text: PDF(484 KB) **IEEE CNF**
Rights and Permissions

28. Expounding the application plan of computer network system to hospital computing
Ma Baoping; Xu Yuanyuan; Ji Zongzheng; Yang Li; Jia Feijuan; Cheng Yingbc
Info-tech and Info-net, 2001. Proceedings. ICII 2001 - Beijing. 2001 Internation on
Volume 6, 29 Oct.-1 Nov. 2001 Page(s):100 - 105 vol.6
Digital Object Identifier 10.1109/ICII.2001.983012
AbstractPlus | Full Text: PDF(333 KB) **IEEE CNF**
Rights and Permissions

29. Adapting to mobile contexts with user-interface modeling
Eisenstein, J.; Vanderdonckt, J.; Puerta, A.;
Mobile Computing Systems and Applications, 2000 Third IEEE Workshop on.
7-8 Dec. 2000 Page(s):83 - 92
Digital Object Identifier 10.1109/MCSA.2000.895384
AbstractPlus | Full Text: PDF(928 KB) **IEEE CNF**
Rights and Permissions

30. A mobile code toolkit for adaptive mobile applications
Kunz, T.; Omar, S.;
Mobile Computing Systems and Applications, 2000 Third IEEE Workshop on.

7-8 Dec. 2000 Page(s):51 - 59
Digital Object Identifier 10.1109/MCSA.2000.895381
AbstractPlus | Full Text: PDF(632 KB) IEEE CNF
Rights and Permissions

31. **A proposal of a memory management architecture for mobile computing**
Yokoyama, S.; Mizuno, T.; Watanabe, T.;
Database and Expert Systems Applications, 2000. Proceedings. 11th Internati
4-8 Sept. 2000 Page(s):28 - 32
Digital Object Identifier 10.1109/DEXA.2000.875000
AbstractPlus | Full Text: PDF(472 KB) IEEE CNF
Rights and Permissions

32. **Real-time transaction management in mobile computing systems**
Kayan, E.; Ulusoy, O.;
Database Systems for Advanced Applications, 1999. Proceedings., 6th Interna
Conference on
19-21 April 1999 Page(s):127 - 134
Digital Object Identifier 10.1109/DASFAA.1999.765744
AbstractPlus | Full Text: PDF(96 KB) IEEE CNF
Rights and Permissions

33. **A new replication strategy for unforeseeable disconnection under agent-computing system**
Lee, K.K.S.; Chin, Y.H.;
Parallel and Distributed Systems, 1998. Proceedings., 1998 International Conf
14-16 Dec. 1998 Page(s):164 - 171
Digital Object Identifier 10.1109/ICPADS.1998.741037
AbstractPlus | Full Text: PDF(96 KB) IEEE CNF
Rights and Permissions

34. **Mobility: a medium for computation, communication, and control**
Mukherjee, A.; Siewiorek, D.P.;
Mobile Computing Systems and Applications, 1994. Proceedings., Workshop o
8-9 Dec. 1994 Page(s):8 - 11
Digital Object Identifier 10.1109/MCSA.1994.512727
AbstractPlus | Full Text: PDF(404 KB) IEEE CNF
Rights and Permissions

35. **Channel occupancy times and handoff rate for mobile computing and PC**
Fang, Y.; Chlamtac, I.; Yi-Bing Lin;
Computers, IEEE Transactions on
Volume 47, Issue 6, June 1998 Page(s):679 - 692
Digital Object Identifier 10.1109/12.689647
AbstractPlus | References | Full Text: PDF(512 KB) IEEE JNL
Rights and Permissions

36. **Software technology for wireless mobile computing**
Duchamp, D.; Feiner, S.K.; Maguire, G.Q., Jr.;
Network, IEEE
Volume 5, Issue 6, Nov. 1991 Page(s):12 - 18
Digital Object Identifier 10.1109/65.103804
AbstractPlus | Full Text: PDF(912 KB) IEEE JNL
Rights and Permissions

37. **Low-cost checkpointing and failure recovery in mobile computing systen**
Prakash, R.; Singhal, M.;
Parallel and Distributed Systems, IEEE Transactions on
Volume 7, Issue 10, Oct. 1996 Page(s):1035 - 1048

Digital Object Identifier 10.1109/71.539735

AbstractPlus | References | Full Text: PDF(1580 KB) **IEEE JNL**
Rights and Permissions

38. **A testing framework for mobile computing software**
Satoh, I.;
Software Engineering, IEEE Transactions on
Volume 29, Issue 12, Dec. 2003 Page(s):1112 - 1121
Digital Object Identifier 10.1109/TSE.2003.1265525

AbstractPlus | References | Full Text: PDF(863 KB) **IEEE JNL**
Rights and Permissions

39. **Developing data allocation schemes by incremental mining of user movi mobile computing system**
Wen-Chih Peng; Ming-Syan Chen;
Knowledge and Data Engineering, IEEE Transactions on
Volume 15, Issue 1, Jan.-Feb. 2003 Page(s):70 - 85
Digital Object Identifier 10.1109/TKDE.2003.1161583

AbstractPlus | References | Full Text: PDF(1116 KB) **IEEE JNL**
Rights and Permissions

40. **Research and implementation of automatic recognition of two dimension mobile computing**
Peizhuo Lv; Shengli Lai; Leian Liu; Yongming Zhuo; Kai Liu;
Mobile Technology, Applications and Systems, 2005 2nd International Confere
15-17 Nov. 2005 Page(s):4 pp.

AbstractPlus | Full Text: PDF(2880 KB) **IEEE CNF**
Rights and Permissions

41. **Mobile computing scheduling mechanism based on self ranking algorith**
Ali, H.A.; Farrag, T.A.; Saleh, M.S.;
Information and Communications Technology, 2005. Enabling Technologies fc Knowledge Society: ITI 3rd International Conference on
5-6 Dec. 2005 Page(s):291 - 305
Digital Object Identifier 10.1109/ITICT.2005.1609631

AbstractPlus | Full Text: PDF(3128 KB) **IEEE CNF**
Rights and Permissions

42. **A virtual machine for the ambient calculus**
Cruz, L.R.G.; Aguirre, O.O.;
Electrical and Electronics Engineering, 2005 2nd International Conference on
7-9 Sept. 2005 Page(s):56 - 59
Digital Object Identifier 10.1109/ICEEE.2005.1529572

AbstractPlus | Full Text: PDF(89 KB) **IEEE CNF**
Rights and Permissions

43. **Energy-aware task allocation over MANETs**
Alsalih, W.; Akl, S.; Hassanein, H.;
Wireless And Mobile Computing, Networking And Communications, 2005. (Wi International Conference on
Volume 3, 22-24 Aug. 2005 Page(s):315 - 322 Vol. 3
Digital Object Identifier 10.1109/WIMOB.2005.1512919

AbstractPlus | Full Text: PDF(628 KB) **IEEE CNF**
Rights and Permissions

44. **Mobile agent based evacuation system when the battery runs out: EAST**
Kaneko, H.; Fukazawa, Y.; Kumeno, F.; Yoshioka, N.; Honiden, S.;
Pervasive Computing and Communications, 2003. (PerCom 2003). Proceedin IEEE International Conference on

23-26 March 2003 Page(s):460 - 469
AbstractPlus | Full Text: PDF(788 KB) **IEEE CNF**
Rights and Permissions

45. **Wireless computational models: mobile agents to the rescue**
Spyrou, C.; Samaras, G.; Pitoura, E.; Evripidou, P.;
Database and Expert Systems Applications, 1999. Proceedings. Tenth Interna on
1-3 Sept. 1999 Page(s):127 - 133
Digital Object Identifier 10.1109/DEXA.1999.795155
AbstractPlus | Full Text: PDF(564 KB) **IEEE CNF**
Rights and Permissions

46. **Proceedings WMCSA'99. Second IEEE Workshop on Mobile Computing S Applications**
Mobile Computing Systems and Applications, 1999. Proceedings. WMCSA '99 Workshop on
25-26 Feb. 1999
Digital Object Identifier 10.1109/MCSA.1999.749270
AbstractPlus | Full Text: PDF(56 KB) **IEEE CNF**
Rights and Permissions

47. **Broadcast of consistent data to read-only transactions from mobile clien**
Kam-Yiu Lam; Mei-Wai Au; Edward Chan;
Mobile Computing Systems and Applications, 1999. Proceedings. WMCSA '99 Workshop on
25-26 Feb. 1999 Page(s):80 - 88
Digital Object Identifier 10.1109/MCSA.1999.749280
AbstractPlus | Full Text: PDF(80 KB) **IEEE CNF**
Rights and Permissions

48. **A dynamic and adaptive cache retrieval scheme for mobile computing sy**
Wen-Chih Peng; Ming-Syan Chen;
Cooperative Information Systems, 1998. Proceedings. 3rd IFCIS International
20-22 Aug. 1998 Page(s):251 - 258
Digital Object Identifier 10.1109/COOPIS.1998.706203
AbstractPlus | Full Text: PDF(164 KB) **IEEE CNF**
Rights and Permissions

49. **On the impossibility of min-process non-blocking checkpointing and an checkpointing algorithm for mobile computing systems**
Guohong Cao; Singhal, M.;
Parallel Processing, 1998. Proceedings. 1998 International Conference on
10-14 Aug. 1998 Page(s):37 - 44
Digital Object Identifier 10.1109/ICPP.1998.708461
AbstractPlus | Full Text: PDF(140 KB) **IEEE CNF**
Rights and Permissions

50. **A system-platform for mobile computing applications**
Diehl, N.; Grill, D.; Held, A.; Kroh, R.;
Personal, Indoor and Mobile Radio Communications, 1994. Wireless Networks Mobile Future. 5th IEEE International Symposium on
Volume 4, 18-23 Sept. 1994 Page(s):1353 - 1358 vol.4
Digital Object Identifier 10.1109/WNCMF.1994.529473
AbstractPlus | Full Text: PDF(496 KB) **IEEE CNF**
Rights and Permissions

View: 1-25 | **26-5**

Help Contact Us Privacy & .

Indexed by
Inspec

Results for "(mobile computing<in>metadata)" e-mail
Your search matched **7470** of **1595071** documents.
A maximum of **100** results are displayed, **25** to a page, sorted by **Relevance** in **Descending** order.

» Search Options

View Session History

New Search

Modify Search

(mobile computing<in>metadata) Search

Check to search only within this results set

Display Format: Citation Citation & Abstract

» Key

IEEE JNL	IEEE Journal or Magazine
IET JNL	IET Journal or Magazine
IEEE CNF	IEEE Conference Proceeding
IET CNF	IET Conference Proceeding
IEEE STD	IEEE Standard

view selected items **Select All** **Deselect All** **View:** 1-25 | 26-5

51. HotMobile 2006: Mobile Computing Practitioners Interact
Ebling, M.R.;
Pervasive Computing, IEEE
Volume 5, Issue 4, Oct.-Dec. 2006 Page(s):102 - 105
Digital Object Identifier 10.1109/MPRV.2006.72
AbstractPlus | Full Text: PDF(112 KB) **IEEE JNL**
Rights and Permissions

52. SOM: dynamic push-pull channel allocation framework for mobile data bı
Jiun-Long Huang; Wen-Chih Peng; Ming-Syan Chen;
Mobile Computing, IEEE Transactions on
Volume 5, Issue 8, Aug. 2006 Page(s):974
Digital Object Identifier 10.1109/TMC.2006.122
AbstractPlus | Full Text: PDF(3592 KB) **IEEE JNL**
Rights and Permissions

53. IEEE Workshop on mobile computing systems and applications
Satyanarayanan, M.;
Personal Communications, IEEE [see also IEEE Wireless Communications]
Volume 2, Issue 2, April 1995 Page(s):11 - 19
Digital Object Identifier 10.1109/98.382528
AbstractPlus | Full Text: PDF(916 KB) **IEEE JNL**
Rights and Permissions

54. An architecture for exporting environment awareness to mobile computiı
Welling, G.; Badrinath, B.R.;
Software Engineering, IEEE Transactions on
Volume 24, Issue 5, May 1998 Page(s):391 - 400
Digital Object Identifier 10.1109/32.685262
AbstractPlus | References | Full Text: PDF(600 KB) **IEEE JNL**
Rights and Permissions

55. Mobile computing and databases-a survey
Barbara, D.;
Knowledge and Data Engineering, IEEE Transactions on
Volume 11, Issue 1, Jan.-Feb. 1999 Page(s):108 - 117
Digital Object Identifier 10.1109/69.755619

AbstractPlus | References | Full Text: PDF(252 KB) IEEE JNL
Rights and Permissions

56. **Mobile agent middleware for mobile computing**
Bellavista, P.; Corradi, A.; Stefanelli, C.;
Computer
Volume 34, Issue 3, March 2001 Page(s):73 - 81
Digital Object Identifier 10.1109/2.910896
AbstractPlus | References | Full Text: PDF(692 KB) IEEE JNL
Rights and Permissions

57. **Mobile computing "Killer app" competition**
Midkiff, S.F.;
Pervasive Computing, IEEE
Volume 1, Issue 3, July-Sept. 2002 Page(s):101 - 104
Digital Object Identifier 10.1109/MPRV.2002.1037729
AbstractPlus | Full Text: PDF(757 KB) IEEE JNL
Rights and Permissions

58. **Derivation of Markov models for effectiveness analysis of adaptable soft architectures for mobile computing**
Grassi, V.; Mirandola, R.;
Mobile Computing, IEEE Transactions on
Volume 2, Issue 2, April-June 2003 Page(s):114 - 131
Digital Object Identifier 10.1109/TMC.2003.1217232
AbstractPlus | References | Full Text: PDF(2845 KB) IEEE JNL
Rights and Permissions

59. **International Workshop on System Support for Future Mobile Computing Title**
Future Mobile Computing Applications, 2006. FUMCA '06. International Works Support for
Sept. 2006 Page(s):i - iii
Digital Object Identifier 10.1109/FUMCA.2006.9
AbstractPlus | Full Text: PDF(157 KB) IEEE CNF
Rights and Permissions

60. **A coordinated spatio-temporal access control model for mobile computi environments**
Fu, S.; Xu, C.-Z.;
Parallel and Distributed Processing Symposium, 2005. Proceedings. 19th IEE
4-8 April 2005 Page(s):8 pp.
Digital Object Identifier 10.1109/IPDPS.2005.10
AbstractPlus | Full Text: PDF(160 KB) IEEE CNF
Rights and Permissions

61. **Characterizing system level energy consumption in mobile computing pl**
Margi, C.B.; Obraczka, K.; Manduchi, R.;
Wireless Networks, Communications and Mobile Computing, 2005 Internation
Volume 2, 13-16 June 2005 Page(s):1142 - 1147 vol.2
Digital Object Identifier 10.1109/WIRLES.2005.1549573
AbstractPlus | Full Text: PDF(1696 KB) IEEE CNF
Rights and Permissions

62. **Mobile context modelling using conceptual graphs**
SuTe Lei; Rang Zhang;
Wireless And Mobile Computing, Networking And Communications, 2005. (Wi International Conference on
Volume 4, 22-24 Aug. 2005 Page(s):131 - 138 Vol. 4

Digital Object Identifier 10.1109/WIMOB.2005.1512960
AbstractPlus | Full Text: PDF(482 KB) **IEEE CNF**
Rights and Permissions

63. **Forced outages information treatment system and cause identification b; computing and neural networks**
Pretto, C.O.; Rancich, G.V.; da Rosa, M.A.; Lemos, F.A.B.;
Power Tech Conference Proceedings, 2003 IEEE Bologna
Volume 1, 23-26 June 2003 Page(s):6 pp. Vol.1
Digital Object Identifier 10.1109/PTC.2003.1304145
AbstractPlus | Full Text: PDF(535 KB) **IEEE CNF**
Rights and Permissions

64. **A Communication-Induced Checkpointing and Asynchronous Recovery I Mobile Computing Systems**
Tantikul, T.; Manivannan, D.;
Parallel and Distributed Computing, Applications and Technologies, 2005. PD(International Conference on
05-08 Dec. 2005 Page(s):70 - 74
Digital Object Identifier 10.1109/PDCAT.2005.5
AbstractPlus | Full Text: PDF(224 KB) **IEEE CNF**
Rights and Permissions

65. **Video deblocking with fine-grained scalable complexity for embedded m(**
Zhenghua Yu; Jian Zhang;
Signal Processing, 2004. Proceedings. ICSP '04. 2004 7th International Confe
Volume 2, 31 Aug.-4 Sept. 2004 Page(s):1173 - 1178 vol.2
Digital Object Identifier 10.1109/ICOSP.2004.1441533
AbstractPlus | Full Text: PDF(327 KB) **IEEE CNF**
Rights and Permissions

66. **Component-based embedded database for mobile embedded systems**
Ahamed, S.I.; Vallecha, S.;
Information Technology: Coding and Computing, 2004. Proceedings. ITCC 20(Conference on
Volume 1, 2004 Page(s):534 - 538 Vol.1
Digital Object Identifier 10.1109/ITCC.2004.1286512
AbstractPlus | Full Text: PDF(1346 KB) **IEEE CNF**
Rights and Permissions

67. **Escape from the computer lab: education in mobile wireless networks**
Belding-Royer, E.M.;
Pervasive Computing and Communications Workshops, 2004. Proceedings of Annual Conference on
14-17 March 2004 Page(s):231 - 235
Digital Object Identifier 10.1109/PERCOMW.2004.1276937
AbstractPlus | Full Text: PDF(234 KB) **IEEE CNF**
Rights and Permissions

68. **Middleware awareness in mobile computing**
Grace, P.; Blair, G.S.; Samuel, S.;
Distributed Computing Systems Workshops, 2003. Proceedings. 23rd Internati on
19-22 May 2003 Page(s):382 - 387
Digital Object Identifier 10.1109/ICDCSW.2003.1203583
AbstractPlus | Full Text: PDF(266 KB) **IEEE CNF**
Rights and Permissions

69. **A low overhead checkpointing protocol for mobile computing systems**

Chi-Yi Lin; Szu-Chi Wang; Sy-Yen Kuo; Ing-Yi Chen;
Dependable Computing, 2002. Proceedings. 2002 Pacific Rim International Sy
16-18 Dec. 2002 Page(s):37 - 44
Digital Object Identifier 10.1109/PRDC.2002.1185616

AbstractPlus | Full Text: PDF(349 KB) IEEE CNF
Rights and Permissions

70. **Service provision based on mobile agents in mobile computing environn**
Fouial, O.; Boukhatem, N.; Demeure, I.;
Mobile and Wireless Communications Network, 2002. 4th International Worksl
9-11 Sept. 2002 Page(s):587 - 591
Digital Object Identifier 10.1109/MWCN.2002.1045833

AbstractPlus | Full Text: PDF(407 KB) IEEE CNF
Rights and Permissions

71. **A location dependent benchmark with mobility behavior**
Seydim, A.Y.; Dunham, M.H.;
Database Engineering and Applications Symposium, 2002. Proceedings. Inter
17-19 July 2002 Page(s):74 - 83
Digital Object Identifier 10.1109/IDEAS.2002.1029658

AbstractPlus | Full Text: PDF(322 KB) IEEE CNF
Rights and Permissions

72. **Working set based location management scheme for mobile computing e**
Moon Seog Han; Seong Bin Im; Young Ik Eom;
High Speed Networks and Multimedia Communications 5th IEEE International
3-5 July 2002 Page(s):278 - 283
Digital Object Identifier 10.1109/HSNMC.2002.1032591

AbstractPlus | Full Text: PDF(620 KB) IEEE CNF
Rights and Permissions

73. **STEAM: event-based middleware for wireless ad hoc networks**
Meier, R.; Cahill, V.;
Distributed Computing Systems Workshops, 2002. Proceedings. 22nd Internat on
2-5 July 2002 Page(s):639 - 644
Digital Object Identifier 10.1109/ICDCSW.2002.1030841

AbstractPlus | Full Text: PDF(305 KB) IEEE CNF
Rights and Permissions

74. **Proceedings Fourth IEEE Workshop on Mobile Computing Systems and ,**
Mobile Computing Systems and Applications, 2002. Proceedings Fourth IEEE
20-21 June 2002
Digital Object Identifier 10.1109/MCSA.2002.1017479

AbstractPlus | Full Text: PDF(286 KB) IEEE CNF
Rights and Permissions

75. **The Mobile Conference Information System. Unleashing academic confe wireless mobile computing**
Okoli, C.; Jessup, L.M.; Ives, B.; Valacich, J.S.;
System Sciences, 2002. HICSS. Proceedings of the 35th Annual Hawaii Intern Conference on
7-10 Jan 2002 Page(s):674 - 681

AbstractPlus | Full Text: PDF(419 KB) IEEE CNF
Rights and Permissions

View: 1-25 | 26-5

Results for "(mobile computing<in>metadata)"
Your search matched **7470** of **1595071** documents.
A maximum of **100** results are displayed, **25** to a page, sorted by **Relevance** in **Descending** order.

e-mail

» **Search Options**

View Session History

New Search

» **Key**

IEEE JNL	IEEE Journal or Magazine
IET JNL	IET Journal or Magazine
IEEE CNF	IEEE Conference Proceeding
IET CNF	IET Conference Proceeding
IEEE STD	IEEE Standard

Modify Search

(mobile computing<in>metadata) Search

Check to search only within this results set

Display Format: Citation Citation & Abstract

view selected items **Select All Deselect All** View: 1-25 | 26-5

76. **Allocation of shared data based on mobile user movement**
Wen-Chih Peng; Ming-Syan Chen;
Mobile Data Management, 2002. Proceedings. Third International Conference
8-11 Jan. 2002 Page(s):105 - 112
AbstractPlus | Full Text: PDF(459 KB) **IEEE CNF**
Rights and Permissions

77. **An adaptive MP3 player: reducing power consumption and increasing ap performance**
Kunz, T.; Omar, S.;
System Sciences, 2002. HICSS. Proceedings of the 35th Annual Hawaii Interr Conference on
7-10 Jan 2002 Page(s):3811 - 3820
AbstractPlus | Full Text: PDF(333 KB) **IEEE CNF**
Rights and Permissions

78. **Pervasive adaptation for mobile computing**
Edmonds, T.; Hodges, S.; Hopper, A.;
Information Networking, 2001. Proceedings. 15th International Conference on
31 Jan.-2 Feb. 2001 Page(s):111 - 118
Digital Object Identifier 10.1109/ICOIN.2001.905340
AbstractPlus | Full Text: PDF(644 KB) **IEEE CNF**
Rights and Permissions

79. **Proceedings 2001 International Conference on Computer Networks and M Computing**
Computer Networks and Mobile Computing, 2001. Proceedings. 2001 Internat on
16-19 Oct. 2001
Digital Object Identifier 10.1109/ICCNMC.2001.962564
AbstractPlus | Full Text: PDF(389 KB) **IEEE CNF**
Rights and Permissions

80. **Proceedings Third IEEE Workshop on Mobile Computing Systems and A**
Mobile Computing Systems and Applications, 2000 Third IEEE Workshop on.
7-8 Dec. 2000
Digital Object Identifier 10.1109/MCSA.2000.895375

AbstractPlus | Full Text: PDF(96 KB) IEEE CNF
Rights and Permissions

81. **Mining user moving patterns for personal data allocation in a mobile con**
Wen-Chih Peng; Ming-Syan Chen;
Parallel Processing, 2000. Proceedings. 2000 International Conference on
21-24 Aug. 2000 Page(s):573 - 580
Digital Object Identifier 10.1109/ICPP.2000.876175

AbstractPlus | Full Text: PDF(680 KB) IEEE CNF
Rights and Permissions

82. **Reliable mobile computing to underground mine**
Sydanheimo, L.; Keskilammi, M.; Kivikoski, M.;
Communications, 2000. ICC 2000. 2000 IEEE International Conference on
Volume 2, 18-22 June 2000 Page(s):882 - 888 vol.2
Digital Object Identifier 10.1109/ICC.2000.853625

AbstractPlus | Full Text: PDF(508 KB) IEEE CNF
Rights and Permissions

83. **A middleware-based architecture to support transparent data access by heterogeneous environments**
Pissinou, N.; Makki, K.; Konig-Ries, B.;
Research Issues in Data Engineering, 2000. RIDE 2000. Proceedings. Tenth I Workshop on
28-29 Feb. 2000 Page(s):63 - 70
Digital Object Identifier 10.1109/RIDE.2000.836501

AbstractPlus | Full Text: PDF(72 KB) IEEE CNF
Rights and Permissions

84. **Concurrent data access in mobile heterogeneous systems**
Lim, J.B.; Hurson, A.R.; Kavi, K.M.;
System Sciences, 1999. HICSS-32. Proceedings of the 32nd Annual Hawaii In Conference on
Volume Track8, 5-8 Jan. 1999 Page(s):10 pp.
Digital Object Identifier 10.1109/HICSS.1999.773060

AbstractPlus | Full Text: PDF(116 KB) IEEE CNF
Rights and Permissions

85. **Resource and load sharing in mobile computing environments**
Le, P.D.; Srinivasan, B.; Malhotra, V.; Mani, N.;
TENCON '98. 1998 IEEE Region 10 International Conference on Global Conn Computer, Communication and Control
Volume 1, 17-19 Dec. 1998 Page(s):82 - 85 vol.1
Digital Object Identifier 10.1109/TENCON.1998.797081

AbstractPlus | Full Text: PDF(352 KB) IEEE CNF
Rights and Permissions

86. **A framework for application adaptation in mobile computing environmen**
Bharghavan, V.; Gupta, V.;
Computer Software and Applications Conference, 1997. COMPSAC '97. Proce Twenty-First Annual International
13-15 Aug. 1997 Page(s):573 - 579
Digital Object Identifier 10.1109/CMPSAC.1997.625071

AbstractPlus | Full Text: PDF(716 KB) IEEE CNF
Rights and Permissions

87. **Seamless networked mobile computing realized by wireless Internet acc**
Ohsawa, T.; Okanoue, K.; Madihian, M.; Ishii, K.; Kakura, Y.;
Communications, 1996. ICC 96, Conference Record, Converging Technologie

Applications. 1996 IEEE International Conference on
Volume 2, 23-27 June 1996 Page(s):792 - 796 vol.2
Digital Object Identifier 10.1109/ICC.1996.541289

AbstractPlus | Full Text: PDF(528 KB) IEEE CNF
Rights and Permissions

88. **Dynamic documents: mobile wireless access to the WWW**
Kaashoek, M.F.; Pinckney, T.; Tauber, J.A.;
Mobile Computing Systems and Applications, 1994. Proceedings., Workshop (
8-9 Dec. 1994 Page(s):179 - 184
Digital Object Identifier 10.1109/MCSA.1994.513480

AbstractPlus | Full Text: PDF(672 KB) IEEE CNF
Rights and Permissions

89. **Processing distributed mobile queries with interleaved remote mobile joi**
Chang-Hung Lee; Ming-Syan Chen;
Computers, IEEE Transactions on
Volume 51, Issue 10, Oct. 2002 Page(s):1182 - 1195
Digital Object Identifier 10.1109/TC.2002.1039844

AbstractPlus | References | Full Text: PDF(877 KB) IEEE JNL
Rights and Permissions

90. **Improving the performance of reliable transport protocols in mobile com| environments**
Caceres, R.; Iftode, L.;
Selected Areas in Communications, IEEE Journal on
Volume 13, Issue 5, June 1995 Page(s):850 - 857
Digital Object Identifier 10.1109/49.391749

AbstractPlus | Full Text: PDF(736 KB) IEEE JNL
Rights and Permissions

91. **Designing mobile computing systems using distributed objects**
Chen, L.T.; Suda, T.;
Communications Magazine, IEEE
Volume 35, Issue 2, Feb. 1997 Page(s):62 - 70
Digital Object Identifier 10.1109/35.565657

AbstractPlus | Full Text: PDF(2716 KB) IEEE JNL
Rights and Permissions

92. **Going mobile [mobile-computing networks]**
Kwun Han; Ghosh, S.;
Circuits and Devices Magazine, IEEE
Volume 14, Issue 1, Jan. 1998 Page(s):10 - 22
Digital Object Identifier 10.1109/101.648595

AbstractPlus | Full Text: PDF(1852 KB) IEEE JNL
Rights and Permissions

93. **A quantitative comparison of ad hoc routing protocols with and without (adaptation**
Xiao-Hui Lin; Yu-Kwong Kwok; Lau, V.K.N.;
Mobile Computing, IEEE Transactions on
Volume 4, Issue 2, March-April 2005 Page(s):111 - 128
Digital Object Identifier 10.1109/TMC.2005.17

AbstractPlus | References | Full Text: PDF(1928 KB) IEEE JNL
Rights and Permissions

94. **A Dynamic Ranking Value Guided Scheduling Mechanism (RVGSM) for M**
Ali, H.A.; Farrag, T.A.;
Computer Engineering and Systems, The 2006 International Conference on

Nov. 2006 Page(s):368 - 373
Digital Object Identifier 10.1109/ICCES.2006.320476

AbstractPlus | Full Text: PDF(7129 KB) **IEEE CNF**
Rights and Permissions

95. **A development of the mobile computing system for repair and patrol of e facilities**
Jin-Ho Shin; Bong-Jae Yi; Jae-Ju Song; Ju-Young Kang; Jung-Il Lee; Seon-Kι
Computer and Information Science, 2005. Fourth Annual ACIS International C·
2005 Page(s):622 - 627
Digital Object Identifier 10.1109/ICIS.2005.5

AbstractPlus | Full Text: PDF(1352 KB) **IEEE CNF**
Rights and Permissions

96. **Mobile computing on telemedicine and distance learning: application on pediatric oncology**
de Britto, J.; Lopes, H.S.; Michalkiewicz, E.L.;
Wireless and Mobile Technologies in Education, 2004. Proceedings. The 2nd I Workshop on
2004 Page(s):139 - 143
Digital Object Identifier 10.1109/WMTE.2004.1281359

AbstractPlus | Full Text: PDF(250 KB) IEEE CNF
Rights and Permissions

97. **Reducing location management costs in hierarchical-based model of mo computing systems**
Seung-yun Kim; Smari, W.W.;
Information Reuse and Integration, 2003. IRI 2003. IEEE International Confere
2003 Page(s):428 - 435
Digital Object Identifier 10.1109/IRI.2003.1251447

AbstractPlus | Full Text: PDF(555 KB) **IEEE CNF**
Rights and Permissions

98. **Local scheduling for distributed cooperation**
Malewicz, G.G.; Russell, A.;
Network Computing and Applications, 2001. NCA 2001. IEEE International Sy
8-10 Oct. 2001 Page(s):244 - 255
Digital Object Identifier 10.1109/NCA.2001.962540

AbstractPlus | Full Text: PDF(1033 KB) **IEEE CNF**
Rights and Permissions

99. **The design of a software technology architecture for mobile computing**
Kan Zhigang; Luo Jun; Hu Jianping;
High Performance Computing in the Asia-Pacific Region, 2000. Proceedings. International Conference/Exhibition on
Volume 2, 14-17 May 2000 Page(s):762 - 763 vol.2
Digital Object Identifier 10.1109/HPC.2000.843541

AbstractPlus | Full Text: PDF(156 KB) **IEEE CNF**
Rights and Permissions

100. **Challenges of communication in mobile computing**
Jun Wei; Tao He; Tao Huang;
Technology of Object-Oriented Languages, 1998. TOOLS 27. Proceedings
22-25 Sept. 1998 Page(s):196 - 203
Digital Object Identifier 10.1109/TOOLS.1998.713601

AbstractPlus | Full Text: PDF(368 KB) **IEEE CNF**
Rights and Permissions

View: 1-25 | 26-5

Help Contact Us Privacy &

Indexed by Inspec

Terms used: **evaggelia pitoura**

Found **18** of **204,472**

Sort results by: relevance

Display results: expanded form

Save results to a Binder

Search Tips

Open results in a new window

Try an Advanced Search

Try this search in The ACM Guide

Results 1 - 18 of 18

Relevance scale

1 Object orientation in multidatabase systems

Evaggelia Pitoura, Omran Bukhres, Ahmed Elmagarmid

June 1995 **ACM Computing Surveys (CSUR)**, Volume 27 Issue 2

Publisher: ACM Press

Full text available: pdf(4.85 MB) Additional Information: full citation, abstract, references, citings, index terms, review

A multidatabase system (MDBS) is a confederation of preexisting distributed, heterogeneous, and autonomous database systems. There has been a recent proliferation of research suggesting the application of object-oriented techniques to facilitate the complex task of designing and implementing MDBSs. Although this approach seems promising, the lack of a general framework impedes any further development. The goal of this paper is to provide a concrete analysis and categorization of the various ...

Keywords: distributed objects, federated databases, integration, multidatabases, views

2 Special topic section on peer to peer data management: DBGlobe: a service-oriented P2P system for global computing

Evaggelia Pitoura, Serge Abiteboul, Dieter Pfoser, George Samaras, Michalis Vazirgiannis

September 2003 **ACM SIGMOD Record**, Volume 32 Issue 3

Publisher: ACM Press

Full text available: pdf(282.99 KB) Additional Information: full citation, abstract, references, citings

The challenge of peer-to-peer computing goes beyond simple file sharing. In the DBGlobe project, we view the multitude of peers carrying data and services as a superdatabase. Our goal is to develop a data management system for modeling, indexing and querying data hosted by such massively distributed, autonomous and possibly mobile peers. We employ a service-oriented approach, in that data are encapsulated in services. Direct querying of data is also supported by an XML-based query language. In.t ...

Keywords: global computing, metadata, peer-to-peer computing, peer-to-peer databases, pervasive computing, services, ubiquitous computing

3 Exploiting Versions for Handling Updates in Broadcast Disks

Evaggelia Pitoura, Panos K. Chrysanthis

September 1999 **Proceedings of the 25th International Conference on Very Large Data**

Bases VLDB '99
Publisher: Morgan Kaufmann Publishers Inc.
Additional Information: full citation, citings

4 Location-based services and mobile computing: data models: Metadata modeling in a global computing environment
Dieter Pfoser, Evaggelia Pitoura, Nectaria Tryfona
November 2002 **Proceedings of the 10th ACM international symposium on Advances in geographic information systems GIS '02**
Publisher: ACM Press
Full text available: pdf(264.88 KB) Additional Information: full citation, abstract, references, citings, index terms

Emerging computational paradigms such as global and ubiquitous computing require some rethinking and innovative research ideas in many computer science areas. In this work, we aim at studying a mobile computing scenario from the database perspective. Given a global computing environment in which data is kept in a number of small-scale, data-charged, mobile devices that use, e.g., wireless networks, for communication, we want to assess the overall data scenario. We use an example to abstract the ...

Keywords: global computing, metadata, mobile computing, mobile devices, mobile ontologies, spatiotemporal databases

5 Keep your data safe and available while roaming
Yolanda Villate, Arantza Illarramendi, Evaggelia Pitoura
August 2002 **Mobile Networks and Applications**, Volume 7 Issue 4
Publisher: Kluwer Academic Publishers
Full text available: pdf(314.83 KB) Additional Information: full citation, abstract, references, index terms

The possibility of accessing and/or receiving local or remote data anywhere and at anytime constitutes an important advantage in many business environments. However, when working with mobile devices, users face many problems, such as: (1) *devise exposure problems* --- mobile devices are more vulnerable and fragile than stationary devices, because they can be easily stolen, lost or damaged, (2) *media problems* --- wireless communications are often unstable, asymmetric and expensive, a ...

Keywords: data storage, mobile computing, multi-agents systems, wireless services

6 Proceedings of the 2nd ACM international workshop on Data engineering for wireless and mobile access
Krithi Ramamritham, Panos K. Chrysanthis, Evaggelia Pitoura
May 2001 proceeding
Publisher: ACM Press
Additional Information: full citation, index terms

7 An efficient hierarchical scheme for locating highly mobile users
Evaggelia Pitoura, Ioannis Fudos
November 1998 **Proceedings of the seventh international conference on Information and knowledge management CIKM '98**
Publisher: ACM Press

Full text available: pdf(1.30 MB) Additional Information: full citation, references, citings, index terms

8 A view-based approach to relaxing global serializability in a multidatabase system
Evaggelia Pitoura, Aidong Zhang, Bharat Bhargava
August 1995 **Proceedings of the fourteenth annual ACM symposium on Principles of distributed computing PODC '95**
Publisher: ACM Press
Full text available: pdf(130.10 KB) Additional Information: full citation, index terms

9 Digital library services in mobile computing
Bharat Bhargava, Melliyal Annamalai, Evaggelia Pitoura
December 1995 **ACM SIGMOD Record**, Volume 24 Issue 4
Publisher: ACM Press
Full text available: pdf(554.86 KB) Additional Information: full citation, abstract, citings, index terms

Digital libraries bring about the integration, management, and communication of gigabytes of multimedia data in a distributed environment. Digital library systems currently envision users as being static when they access information. But it is expected in the near future that tens of millions of users will have access to a digital library through wireless access. Providing digital library services to users whose location is constantly changing, whose network connections are through a wirele ...

10 A framework for providing consistent and recoverable agent-based access to heterogeneous mobile databases
Evaggelia Pitoura, Bharat Bhargava
September 1995 **ACM SIGMOD Record**, Volume 24 Issue 3
Publisher: ACM Press
Full text available: pdf(728.00 KB) Additional Information: full citation, abstract, citings, index terms

Information applications are increasingly required to be distributed among numerous remote sites through both wireless and wired links. Traditional models of distributed computing are inadequate to overcome the communication barrier this generates and to support the development of complex applications. In this paper, we advocate an approach based on agents. Agents are software modules that encapsulate data and code, cooperate to solve complicated tasks, and run at remote sites with minimum inter ...

Keywords: agents, concurrency control, mobile computing, multidatabases, recovery, transactions, workflow

11 Building information systems for mobile environments
Evaggelia Pitoura, Bharat Bhargava
November 1994 **Proceedings of the third international conference on Information and knowledge management CIKM '94**
Publisher: ACM Press
Full text available: pdf(907.91 KB) Additional Information: full citation, abstract, references, citings, index terms

It is expected that in the near future, tens of millions of users will have access to distributed information systems through wireless connections. The technical characteristics of the wireless medium and the resulting mobility of both data resources and data consumers raise new challenging questions regarding the development of information systems appropriate for mobile environments. In this paper, we report on the

development of such a system. First, we describe the general architecture o ...

Keywords: consistency, information systems, mobile computing, new applications, transaction management

12 Paper session DB-8 (databases): query optimisation: Query workload-aware overlay construction using histograms
Georgia Koloniari, Yannis Petrakis, Evaggelia Pitoura, Thodoris Tsotsos
October 2005 **Proceedings of the 14th ACM international conference on Information and knowledge management CIKM '05**
Publisher: ACM Press
Full text available: pdf(238.28 KB) Additional Information: full citation, abstract, references, index terms

Peer-to-peer(p2p) systems over an efficient means of data sharing among a dynamically changing set of a large number of a tonomous nodes.Each node in a p2p system is connected with a small number of other nodes thus creating an overlay network of nodes. A query posed at a node is routed through the overlay network towards nodes hosting data items that satisfy it. In this paper, we consider building overlays that exploit the query workload so that nodes are clustered based on their results to a g ...

Keywords: clustering, overlay network, peer-to-peer systems, query routing, range queries, small worlds

13 Research articles and surveys: Peer-to-peer management of XML data: issues and research challenges
Georgia Koloniari, Evaggelia Pitoura
June 2005 **ACM SIGMOD Record**, Volume 34 Issue 2
Publisher: ACM Press
Full text available: pdf(301.94 KB) Additional Information: full citation, abstract, references, index terms

Peer-to-peer (p2p) systems are attracting increasing attention as an efficient means of sharing data among large, diverse and dynamic sets of users. The widespread use of XML as a standard for representing and exchanging data in the Internet suggests using XML for describing data shared in a p2p system. However, sharing XML data imposes new challenges in p2p systems related to supporting advanced querying beyond simple keyword-based retrieval. In this paper, we focus on data management issues fo ...

14 Paper session I: quality models: ETL queues for active data warehousing
Alexandros Karakasidis, Panos Vassiliadis, Evaggelia Pitoura
June 2005 **Proceedings of the 2nd international workshop on Information quality in information systems IQIS '05**
Publisher: ACM Press
Full text available: pdf(577.05 KB) Additional Information: full citation, abstract, references, citings

Traditionally, the refreshment of data warehouses has been performed in an off-line fashion. Active Data Warehousing refers to a new trend where data warehouses are updated as frequently as possible, to accommodate the high demands of users for fresh data. In this paper, we propose a framework for the implementation of active data warehousing, with the following goals: (a) minimal changes in the software configuration of the source, (b) minimal overhead for the source due to the active nature of ...

15 Mobility in agents, sensors and services: Concept-based discovery of mobile services
Chara Skouteli, George Samaras, Evaggelia Pitoura
May 2005 **Proceedings of the 6th international conference on Mobile data**

management MDM '05
Publisher: ACM Press
Full text available: pdf(292.22 KB) Additional Information: full citation, abstract, references

In this paper, we consider semantic service discovery in a global computing environment. We propose creating a dynamic overlay network by grouping together semantically related services. Each such group of services is termed a community. Communities are organized in a global taxonomy whose nodes are related contextually. The taxonomy can be seen as an expandable distributed semantic index over the system services, which aims at improving service discovery. Our performance results indicate that i ...

Keywords: mobile computing, pervasive computing, service discovery

16 Guest editorial
Panos K. Chrysanthis, Evaggelia Pitoura
November 2004 **Wireless Networks**, Volume 10 Issue 6
Publisher: Kluwer Academic Publishers
Full text available: pdf(38.82 KB) Additional Information: full citation, index terms

17 Special issue on Mobile Data Management: Mobile agent-based services for view materialization
Kyriakos Karenos, George Samaras, Panos K. Chrysanthis, Evaggelia Pitoura
July 2004 **ACM SIGMOBILE Mobile Computing and Communications Review**, Volume 8 Issue 3
Publisher: ACM Press
Full text available: pdf(537.45 KB) Additional Information: full citation, abstract, references

Mobile agents are ideal for mobile computing environments because of their ability to support asynchronous communication and disconnected data processing. In this paper, we present a prototype set of extensible mobile-agent based services that allow the definition, materialization, maintenance and sharing of views created over remote web-accessible datasources, called V<i>i</i>SMA (Views Supported by Mobile Agents). V<i>i</i>SMA's primary goal is to support the customization a ...

18 Communication Issues in Wide Area Networks for Digital Libraries (abstract only)
Bharat Bhargava, Melliyal Annamalai, Shalab Goel, Shunge Li, Evaggelia Pitoura
August 1994 **ACM SIGOIS Bulletin**, Volume 15 Issue 1
Publisher: ACM Press
Full text available: pdf(132.06 KB) Additional Information: full citation

Results 1 - 18 of 18

Building Information Systems for Mobile Environments

Evaggelia Pitoura*
Department of Computer Science
Purdue University
West Lafayette, IN 47907-1398
pitoura@cs.purdue.edu

Bharat Bhargava
Department of Computer Science
Purdue University
West Lafayette, IN 47907-1398
bb@cs.purdue.edu

Abstract

It is expected that in the near future, tens of millions of users will have access to distributed information systems through wireless connections. The technical characteristics of the wireless medium and the resulting mobility of both data resources and data consumers raise new challenging questions regarding the development of information systems appropriate for mobile environments. In this paper, we report on the development of such a system. First, we describe the general architecture of the information system and the main considerations of our design. Then, based on these considerations, we present our system support for maintaining the consistency of replicated data and for providing transaction schemas that account for the frequent but predictable disconnections, the mobility, and the vulnerability of the wireless environment.

Keywords: New Applications, Information Systems, Mobile Computing, Transaction Management, Consistency.

1 Introduction

In the recent past, technical advances in the development of portable computers and the rapidly expanding cordless technology have provided the basis for accessing information systems through wireless connections. Today, when users move, unplug their computer from some local area network, transport it, and plug it back to the local area network at their destination. Wireless technology provides users with the ability to retain their network connection even while moving. This new computing paradigm is called *mobile* or *nomadic* computing. Mobile computing can be viewed as adding a new dimension to the broader vision of universal access to information that allows the mobility of data consumers and data resources.

Until recently, infrastructure research pertaining to mobile computing has mostly focused on networking and operating systems [18, 8, 17, 25, 4, 23]. Research in networking and communications includes new addressing and routing schemas, support for efficient multicasting and broadcasting, data compression, and relocation transparency. Research in operating system addresses security issues, file systems that support disconnected operation, and caching techniques. However, the issues introduced go beyond those areas and directly affect information management systems [3, 15, 20]. Mobile computing introduces new challenging problems concerning resource management, information acquisition [16], and data distribution [13].

In this paper, we report on the design of an information system for a mobile environment. The goal of this paper is twofold. First, we give a general overview of the organization of the system and of the important concerns of our design. Second, we focus on our system support for consistency and transactions and show how our schema is in compliance with the general architecture and design concerns.

The structure of this paper is as follows. In Section 2, we introduce the physical architecture, and identify the characteristics of both the wireless medium and the mobile hosts. In Section 3, we define the operation modes of a mobile host, present the general object-based architecture of the information system, and introduce the main considerations of the design. The following two sections focus on consistency and transaction management. Section 4 describes our schema for maintaining the consistency of replicated data. The novelty of this schema is the existence of two types of operations (loose and strict) that allows users to specify the required degree of consistency of their input data. The schema takes into consideration the modes of operation and the peculiarities of the mobile environment. Section 5 discusses the structure of a mobile computation. We argue that flat transactions are inadequate for modeling interactions in a mobile environment and we propose appropriate extensions that account for mobility and recovery. In Section 6, we report briefly on the status of our system. We conclude in Section 7 by summarizing the main results of our work.

2 The Characteristics of the Mobile Environment

Distributed systems that support mobility are physically structured as shown in Figure 1 [15]. The architecture consists of two distinct types of hosts: mobile and fixed hosts. Some of the fixed hosts, called *base stations* or *mobile support stations*, are augmented with a wireless interface to communicate with mobile hosts. The geographical area covered by a base station is called a *cell*. Each mobile host can directly communicate with one base station, the one cover-

*supported by a Purdue Research Foundation fellowship

CIKM '94- 11/94 Gaithersburg MD USA
© 1994 ACM 0-89791-674-3/94/0011..$3.50

ing the geographical area in which the mobile host moves. The process during which a mobile host enters a new cell is called *hand-off*. To accommodate smooth hand-off, cells usually overlap.

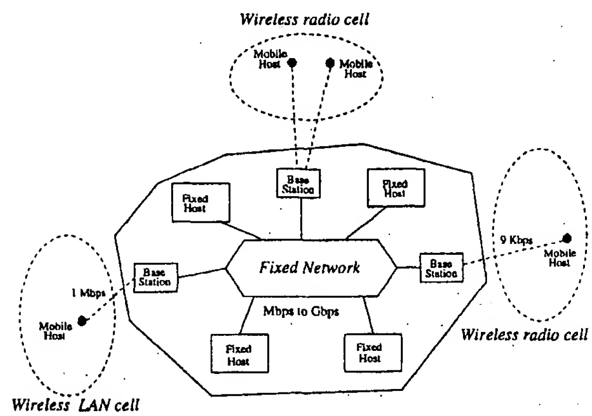

Figure 1: Mobile System Architecture

2.1 The Wireless Medium

The networking infrastructure (also called Personal Communication Network (PCN)) is expected to include [9, 15, 3]:

- *cellular or packet radio* modems (e.g., Ericson GE's Mobidem), which are characterized by high costs, large range coverage, and relatively small bandwidth;
- *satellite services* (e.g., Motorola's Iridium), which provide wide coverage, but are very expensive, usually receive-only and of very low bandwidth; and
- *wireless LANs* (traditional LANs extended with a wireless interface, e.g., NCR WaveLAN, Motorola's ALTAIR, Proxims Range LAN and Telesystem's ARLAN), which provide connectivity with low cost within a very small geographical area (at a range of few kilometers).

While the growth in physical network bandwidth has been tremendous (in current technology Ethernet provides 10Mbps, FDDI 100 Mbps and ATM 155 Mbps), products for wireless communication achieve only 2Mbps for radio communication, and 9-14 kbps for cellular telephony [9]. The typical bandwidth of wireless LANs ranges from 250 bps to 2Mbps and it is expected to increase to 10Mbps. Since the bandwidth is divided between the users sharing a shell, the deliverable bandwidth per user will be even lower. Thus, it is safe to assume that bandwidth will continue to be a scarce resource. Furthermore, an additional reason that makes bandwidth consumption a major concern of mobile computing designs, is that data transmission over the air is *monetarily expensive* [12].

In comparison with non-mobile environments, disconnections are much more frequent. Furthermore, the wireless medium is characterized by much greater variation in network bandwidth than traditional designs, leading to various *degrees of disconnections* depending on the available bandwidth and noise of the communication channel [9, 14]. Certain disconnections are considered *foreseeable*, since they can be detected by changes in the signal strength, by predicting the battery's lifetime, or by utilizing knowledge of the bandwidth distribution [3, 14].

Product	RAM	MHz	CPU	Batteries hours, type	Weight lbs	Display sq. inches
Amstard Pen Pad PDA600	128 KB	20	Z80	40, AAs	0.9	10.4
Apple Newton Message Pad	640KB	20	ARM	6-8, 4 AAAs	0.9	11.2
At&T E0 440	4-12 MB	20	Hobbit	1-6, NiCad	2.2	25.7

Table 1: Typical Values of Mobile Hosts

2.2 Mobile Hosts

Mobile hosts, regardless of future technology advances, will have limited computing power, memory and screen size as a result of their small size and weight. Some typical values are shown in Table 1 [9]. Mobile hosts range from small palmtops (e.g., Apple Newton) or specialized data entry devices (like the ones used by UPS) to tabletop computers with wireless interfaces (e.g., AT&T EO). Mobile hosts have limited battery capacity, two or three hours under normal use, which is expected to increase only 20% over the next 10 years. Due to this fact, energy preservation is an important consideration. Moreover, mobile hosts are more susceptible to loss, destruction and theft than static hosts. Table 2 summarizes the characteristics of the wireless medium and of the mobile hosts.

characteristics of the wireless medium	characteristics of mobile hosts
low bandwidth frequent disconnections high bandwidth variability predictable disconnections monetarily expensive broadcast is physically supported in a cell	small size small screen limited battery life susceptible to theft, and accidents

Table 2: Summary of the Characteristics

3 System Overview

In this section we provide an overview of an information system for a mobile environment. First, we define the modes of operation, then we describe the general architecture, and finally, we conclude with two important considerations in the design of the system.

3.1 Operation Modes

While in a nonmobile distributed system a host operates in one of two modes regarding its connection to the rest of the network (either connected to it or totally disconnected from it) in a mobile environment there are more modes of operation. We model the different modes of operation of a mobile host using the state diagram shown in Figure 2.

The degree of connection is related to the availability of bandwidth. Since total and partial disconnections are very frequent, they should not be treated as failures. On the contrary, a mobile host should be capable of operating even under low or no connection with the fixed network. A

mobile host operates in a *partly disconnected* mode when the communication through the wireless network is weak.

In addition to the modes related to the type of connection with the fixed network, a mobile host may switch to the *doze mode* for preserving energy. While in this mode, the clock speed is reduced and no user computation is performed. The mobile host returns to normal operation upon receipt of any message.

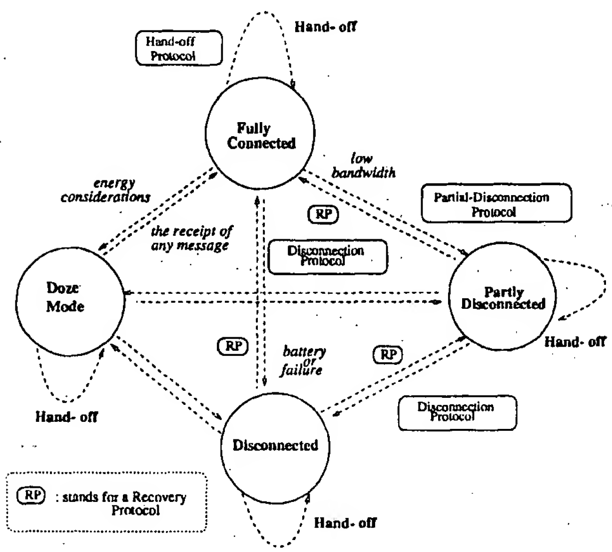

Figure 2: Operation Modes of a Mobile Host

Since most of the transitions between modes are predictable, protocols can be designed to prepare the system for a transition.

- A *disconnection protocol* is executed before the mobile host is physically detached from the fixed network. The protocol should ensure that enough information is locally available to the mobile host for its autonomous operation during disconnection. It should also notify any interested parties for the forecoming disconnection.
- A *partial-disconnection protocol* prepares the mobile host for operation in a mode where all communication with the fixed network should be as restricted as possible. Selective caching can be used for caching data, whose presence in the host will minimize future network use.
- *Recovery protocols* re-establish the connection with the fixed network and resume normal operation.
- *Hand-off protocols* refer to crossing the boundaries of a cell. State information pertaining to the mobile host should be transferred to the base station of the new cell.

Part of these protocols is handled by low-level system operations. However, the modes are not necessarily completely transparent to the applications. Support by the application (in our case by the information management system) can lead to performance gains. For example, information about the type of application can be used to design caching techniques or limit network access.

In this paper, we focus on how system support for transactions and consistency maintenance can take into account the modes of operation to increase performance and availability. Specifically, in Section 4, we present a replication controller, which adjusts with the type of connection. In Section 5, we introduce the concept of transaction migration to handle hand-offs.

3.2 The Architecture of the Information System

Users of mobile hosts will have access to a variety of information resources, which will be located in both mobile and static hosts. An architecture for such systems must take into account the following facts:

- Although, some of the information resources will be provided by information systems especially tailored for such use, many of them will be provided by *pre-existing* applications that were built without taking into account the possibility of their future access through wireless connections. Rather than rebuilding the applications, superimposing upon them appropriate interfaces is a more realistic approach.
- An intrinsic characteristic of these information resources is their *heterogeneity*. Heterogeneity is the inevitable result of an expected increase in the scale of distributed systems with the introduction of mobile hosts. Furthermore, the use of wireless connections results in users entering new cells and possibly heterogeneous environment during a single session.
- The architecture must support extensibility and portability. Compliance with evolving standards such as CORBA [11] and ODP [24] is a step towards this direction.

Because of the above considerations, an *object-based architecture* seems to be appropriate to serve as the architecture of a mobile information system. A Distributed Object Management System (DOMS) consists of a number of distributed hosts and clients [19]. Each host supports one or more information systems. Together, the hosts constitute the system's information resources. Special *Object Servers* or *Object Managers* are responsible for building appropriate interfaces so that the system's resources appear as objects. Clients request operations by sending messages to objects. These messages are handled by object servers which direct them to the appropriate hosts.

Object-based architectures are suitable for the following reasons:

- Special *Mobile-Object Servers* can be built that will offer appropriate methods for accessing data from mobile hosts. These methods will account for the wireless of the medium and the fact that the location of a client is a frequently changing data, see Figure 3.
- Object-based architectures hide the heterogeneity of the environment, since the response to a message depends only on the interface and not on the internal implementation of the object or the method.
- Most proposals for standards are based on the distributed object paradigm.

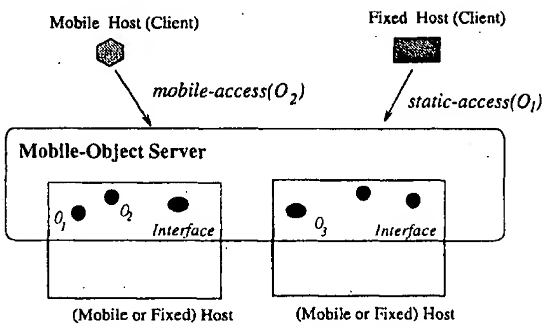

Figure 3: Object-based Architecture, objects O_i correspond to resources stored in static and mobile hosts

The distributed object-based architecture provides the high-level architecture of the distributed heterogeneous information system. Internally, each information system that participates in the object-based architecture may support its own data model. What would be an appropriate internal data model for a local mobile database is not clear yet, but it should support graphical interfaces and take into account the inherent heterogeneity of the mobile environment [2].

Location Databases. In addition to the servers that will provide wireless access to general information resources, the system should maintain servers that offer access to information systems that contain location-related information. We assume at least two such databases, one per user that would include the user's home address and other user-related information and one per base station that would include information about all hosts under its cell. Location databases are:

- fast changing,
- geographical,
- distributed and replicated over many sites to support efficient access,
- imprecise, since the overhead for keeping them up-to-date may be overwhelming.

Data stored in location databases may participate in queries. This results in queries that are:

- of different complexity in terms of location constraints,
- geographical and moreover dependent on the location of the user (e.g. find the nearest restaurant),
- real-time,
- imprecise,
- dependent on the user's direction of move

Query issues involving location data are discussed in [16]. In Section 4, we discuss issues regarding the consistency of such data.

3.3 Two Important Considerations

Two issues of particular interest in designing information systems for mobile environments are to determine the role of a mobile host in a distributed computation and to *personalize* the computation. We discuss them further.

The Role of a Mobile Host. There is no agreement yet on the role of a mobile host in a distributed environment. The possibilities range from that of a dumb terminal with no autonomy to that of a relatively independent component with enough memory and computing power to perform part of the distributed computation locally. Each approach has both advantages and disadvantages. Performing part of the computation on a mobile host:

- costs in terms of power consumption,
- complicates data replication and integrity preservation,
- adds to the search cost of locating the mobile hosts and the data that they produce and consume.

On the other hand, it

- allows the autonomous operation of a mobile host during partial and total disconnections,
- limits bandwidth use,
- saves the energy cost for the transmission of data to and from the fixed network.

In our design, we adopt the approach that part of the computation will be executed in a mobile host, since allowing a mobile host to operate autonomously is crucial considering the frequency of disconnections. But still, since mobile hosts are susceptible to failures and accidents, part of the computation must be reported to the fixed network. In Section 5, we introduce the notion of transaction proxies that provides transaction support for backing-up the computation in the fixed network.

User's Profile. Utilizing information about users gains increasing importance as information systems scale in size. We assume that this information is stored in a *user's profile*. Information about users is very important to data navigation since it can be used to select the information that is of interest to a particular user. For instance, users may be informed for the release of the latest album of their favored artist. Specifically in mobile environments, the user's profile may also include information about the user's *mobility pattern*, for instance the fact that each day he commutes to his office. The user's profile can be part of the location database of the user.

In mobile systems research the user's profile has been widely used, for example to determine which data to cache before disconnections [18], or to optimize queries about location [16]. In our schema, we propose utilizing information stored in a user's profile to define consistency clusters (Section 4) and to simulate mobility (Section 6).

4 Consistency of Replicated Data

Communication through the wireless network is very expensive both monetarily and in terms of bandwidth consumption. As a consequence, performing operations locally in

a mobile host can lead to performance gains and increase availability during total and partial disconnections. On the other hand, maintaining full consistency among data saved in fixed and mobile hosts imposes unbearable overheads in mobile environments [3, 14, 20]. We propose a more flexible model. The formal definition of the model, its scope and the associated correctness criteria are presented in [21]. The presentation of the model in this section aims at demonstrating how the operation modes and the other general considerations are taken into account in designing the replication controller of our information system.

4.1 Clustering

We partition the data items of a mobile database into *clusters*. All replicas in a cluster are synchronized, while replicas at different clusters may vary by some appropriately defined degree. In that sense, a cluster is the unit of consistency. The degree of inconsistency may vary based on the availability of network bandwidth by allowing small deviation among the copies in cases of higher bandwidth availability and higher deviation in cases of low bandwidth availability. The cluster configuration is *dynamic* rather than static. When clusters are merged the values of all copies of a data item are reconciled.

Defining Degrees. There are many alternative ways of defining degrees [22]. The *degree* may express the divergence from the value of the primary copy [1]. In this case, the allowable degree may be bounded by limiting the number of versions, by setting a maximum value on the allowable deviation, or by limiting the number of transactions that can operate on inconsistent values. Alternatively, we can define the degree as the number of data items or the number of data copies per data item that can diverge.

Defining Clusters. One possible way of defining a cluster is by grouping together data residing in the same or neighboring hosts. For instance, data stored in hosts that are partially or totally disconnected from the fixed network may be considered as forming a cluster (Figure 4). In this case, by taking advantage of the predictable nature of disconnections, clusters of data may be created or merged upon a forecoming disconnection or connection of the associated mobile host. Furthermore, clusters may be defined based on the type of data. A characteristic example of such data is the data representing the *location* of mobile hosts. Since this type of data are fast-changing, the maintenance of their full consistency could cause unbearable overheads. In addition, users may explicitly define clusters based on the semantics of their data or applications. Finally, information stored in a *user's profile* may also be utilized to determine clusters. For example, data that are most frequently accessed by a user or data that are to a great extent private to a user can be considered as belonging to the same cluster independently of their location.

4.2 Handling Loose Consistency

To maximize local processing and limit network accesses, we allow users to interact with locally (within a cluster) available data by introducing two new kinds of operations, loose reads and loose writes. These operations allow users to operate on loosely consistent data when the lack of strict consistency does not affect the semantics of their transactions. Allowing users to operate on local data is especially

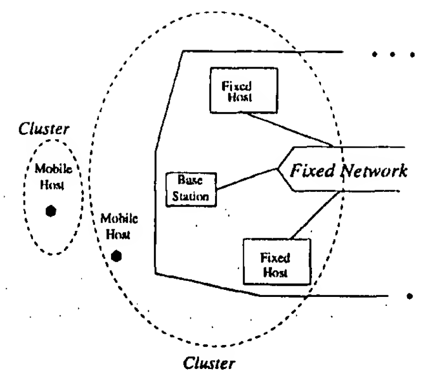

Figure 4: A possible cluster configuration, where clustering is based on location

important during total or partial disconnection since those data are then the only data that are accessible or affordable to access. We call the standard read and write operations strict read and strict write operations to differentiate them from the loose operations.

Specifically, a loose read ($LR[a]$) reads the value written by the last loose or strict write operation on a *locally* available copy, that is on a copy in its cluster. A *loose write* operation ($LW[a]$) writes some local copies and is not permanent unless it is finally committed after cluster merging. A *strict read* operation ($SR[a]$) reads the value written by the last strict write operation on a copy located in *any* of the clusters. Finally, the value written by a *strict write* operation ($SW[a]$) becomes permanent after commitment. Our method can be implemented as a 2-version method, where local transaction managers maintain two copies of a data item, one that is updated by strict writes and one that is updated by both strict and loose writes. The first is read by strict read operations and the second by loose read operations.

Two Types of Basic Transactions. We distinguish two types of transactions:

(a) transactions that consist only of loose read and loose write operations and are called *loose transactions*; and

(b) transactions that consist only of strict read and strict write operations and are called *strict transactions*.

Loose transactions are locally committed in their associated clusters. Updates performed by locally committed transactions are revealed only to other loose transactions in the same cluster. These changes are revealed to strict transactions only after merging, when local transactions become globally committed. Before being globally committed, a loose transaction may be undone even after it has been locally committed.

A loose transaction is a transaction that may read loosely consistent data and whose writes may be undone any time before merging. Strict transactions have the usual semantics. Loose transactions are suitable for applications that do not require exact values of data such as gathering information for statistical purposes. Allowing updates in loose

	$LR_j(a_k)$	$SR_j(a_k)$	$LW_j(a_k)$	$SW_j(a_k)$
$LR_i(a_k)$			X	X
$SR_i(a_k)$				X
$LW_i(a_k)$	X		X	X
$SW_i(a_k)$	X	X	X	X

Table 3: Conflict relation, a "x" entry indicates that the operations for the given row and column conflict. Row entries correspond to operations of transaction T_i and column entries to operations of a transaction T_j, where $i \neq j$

transactions adds functionality. These updates are finally committed only if they do not conflict with the operations of a strict transaction. Thus, loose updates are especially useful in two cases: (a) for handling private or seldomly accessed data for which conflicts are rare, and (b) for transactions for which compensating actions are possible.

Users or application developers are able to specify the loose or strict requirements of their transactions through a high-level interface. Then, the operations of each transaction are automatically translated into loose or strict operations according to the given specifications.

Correctness. Two operations of the same transaction conflict if they both access the same data copy and at least one of them is a write. Operations of two different transactions that are executed before cluster merging conflict as shown in Table 3. Upon merging of clusters we adopt a strictly syntactic approach to establishing full consistency. We undo all loose transactions whose loose writes conflict with a strict transaction. We have proven that undoing a loose transaction can result in undoing only loose transactions in the same cluster [21]. Serializability-based criteria for the correctness of schedules before and after merging are formally defined in [21]. In [21], we have also presented graph-based tests for the serializability of the corresponding schedules and compare our work with other weak consistency proposals in the database and operating system communities.

5 Transactions in a Mobile Environment

Loose and strict transactions are generic transactions that can be considered *part* of a general mobile transaction that models the interaction of a user with a mobile distributed system. Generally speaking, a *mobile transaction* is a distributed transaction T, where some parts of the computation are executed on mobile and some parts on nonmobile hosts. The model for such a transaction that involves data stored in both the fixed and the wireless network has not emerged yet.

A large number of transactions in a mobile environment is expected to be read-only transactions, where users will query large amount of data. Still, some applications such as inventory control, banking applications and travel reservations will require updates. For instance, a traveling salesman will update an inventory database to reflect the fact that an item has been sold. Consumers will use their mobile host to book flights, buy tickets or do banking transactions.

An important issue is what part and how large a part of a transaction will be executed on a mobile host. This is related to the role of a mobile host in a mobile distributed environment. Operations on a mobile host may minimize network access, and optimize response time. On the other hand, they cost in terms of local resource consumption (especially battery). But the decisive factor for answering this question is frequent disconnections. To allow the operation of a mobile host during disconnections part of the computation must be executed locally.

The Characteristics of Mobile Transactions. We identify the following as the characteristics of a mobile transaction:

- Mobile transactions are transactions that involve the wireless network and may be executed in both mobile and nonmobile hosts.
- Using the *wireless medium* has the following consequences. Transactions tend to be:
  1. monetarily expensive;
  2. long lived, because of long network delays;
  3. error-prone, because of frequent disconnections but also because mobile hosts are more prone to accidents than fixed hosts; and
  4. session-based. For some technologies, such as cellular modems, there is a high start-up charge for each communication. Cost-effective transaction management may adopt the approach of supporting few long-lived session-based transactions instead of many short-lived transactions.
- *Mobility* results in transactions with the following characteristics:
  1. Transactions access heterogeneous information systems.
  2. Transactions access (possibly imprecise) location data.
  3. Transactions may involve data that are dynamically relocated.

Modeling Mobile Transactions. Mobile transactions are long-running, error-prone and heterogeneous. As a consequence, modeling mobile transactions as ACID transactions is very restrictive. ACID transactions have limited expressive power and offer no way of modeling computations with a complex control structure. Furthermore, ACID transactions do not support partial commitment or abortion of a transaction, or partial recovery. Finally, there is no way of "suspending" a transaction to survive a disconnection.

It seems that an *open-nested model* [10] is more appropriate for modeling mobile transactions. In that model, each transaction consists of a number of subtransactions with a specified set of dependencies. The set of dependencies varies based on the application and it can be customized. In [7], an axiomatic definition of a transaction model for mobile transactions is presented. Our approach is different in that, instead of defining a powerful, general transaction model,

we identify the *generic characteristics* that this model must support to be appropriate for a mobile environment.

Specifically, to deal with the particularities of the wireless medium, we have introduced *loose transactions.* Loose transactions support disconnected operation and minimize bandwidth use. Moreover, they are capable of modeling operations on imprecise data, such as location data. In this section we investigate further on the structure of mobile transactions. We present two generic techniques:

- To deal with the mobility of the environment we introduce the concept of *transaction migration.*
- To deal with the vulnerability of the mobile hosts we introduce the concept of a *transaction proxy.*

5.1 Transaction Migration

A mobile host may enter a new cell while in operation. In that case, it may be necessary to *migrate* part of the computation that was executed in one fixed host to another fixed host. One motivation for migration is improvement in performance. By moving the computation close to the mobile host, the communication cost is minimized. Transaction migration (relocation) can be thought of as the dual of data relocation. In addition, transaction migration may lead to a better load balance among base stations. Furthermore, a base station may not be willing to support computation initiated by users that are not any more in its cell, for instance for security reasons. In that case, transactions submitted to the old base station and partially executed there must be transferred to the new base station.

Let T_i be a transaction that was initially submitted at site i and then was migrated to site j. We use the notation $T_{i \rightarrow i}$ for the part executed at site i and $T_{i \rightarrow j}$ for the part executed at site j. $T_{i \rightarrow i}$ cannot be committed at site i but it may conditionally release some of the local resources it holds. $T_{i \rightarrow j}$ inherits state information from $T_{i \rightarrow i}$. That information depends on the consistency control method used. It may include timestamps, requested and granted locks, or log files.

5.2 Transaction Proxies

To deal with the fact that mobile hosts are more susceptible to theft accidents and frequent disconnections, we must report part of the computation that is performed in a mobile host to the fixed network. We model that using the concept of *transaction proxies.* For each transaction T_i executed at a mobile host i, we define a dual transaction PT_j, called proxy, that will be executed on host j, where j is the base station of i.

A proxy transaction may be considered as a subtransaction of the original transaction. Thus, any time a subtransaction is submitted to a mobile host its proxy transaction is submitted to its base station. The proxy transaction includes only the updates of the original transaction. Alternatively, proxy transactions may be executed off-line. In that sense, proxy transactions correspond to taking periodic back-ups of the computation which is performed on a mobile host. We are investigating necessary criteria for scheduling proxies at fixed hosts in a sound and efficient way.

6 Status Report

We are currently developing an information system on top of ORAID [5]. ORAID is an object-oriented system built on top of RAID [6], a distributed database system that has been proven successful in supporting experiments in communication, adaptability, and transaction processing. We are modifying the communication library routines [26] to simulate the wireless communication. Mobility is captured by connecting our simulated mobile station with different base stations. We assign to each host that simulates a mobile host, a fixed host which serves as its base station. The mobile host can then directly communicate only with its assigned base station. The assignment of base stations to mobile hosts is dynamic and is driven by the mobility pattern as specified in each user's profile.

In addition to the traditional performance measurements mobile computing introduces new performance concerns, including:

- energy preservation (battery is a limited resource);
- prudent use of bandwidth (bandwidth in mobile environment is a very scarce and expensive resource); and
- the degree of autonomy during weak or total disconnections (since disconnections are frequent, mobile computers should be able to operate even while disconnected).

We intend to provide system support for loose transactions, migration and proxies and study the performance of these mechanisms.

7 Summary

Wireless communications offer the exciting possibility of accessing information independent of location and movement. This possibility raises new challenges to the design of information systems. In this paper we have reported on the design of such a system. The contribution of this paper is twofold. First we have:

- defined the operation modes of a mobile host;
- proposed a general object-based architecture for information systems appropriate for mobile environments; and
- identified the main concerns in designing mobile information systems.

Second, we have shown how these general principles can be used to provide system support for transactions in a mobile environment. Specifically, we have introduced:

- loose transactions to deal with the frequent, predictable and of various degrees disconnections,
- transaction migration to model mobility, and
- transaction proxies to handle recovery.

Finally, we have briefly reported on the status of our system and discussed performance criteria for testing the proposed techniques.

References

[1] Rafael Alonso, Daniel Barbara, and Hector Garcia-Molina. Data Caching Issues in an Information Retrieval System. *ACM Transactions on Database Systems*, 15(3):359–384, September 1990.

[2] Rafael Alonso, Eben M. Haber, and Henry F. Korth. A Mobile Computer Interface for Heterogeneous Databases. In *Proceedings of the RIDE-IMS'93 Workshop*, Vienna, Austria, April 1993.

[3] Rafael Alonso and Henry F. Korth. Database System Issues in Nomadic Computing. In *Proceedings of the 1993 SIGMOD Conference*, Washington, D.C., May 1993.

[4] Baruch Awerbuch and David Peleg. Concurrent Online Tracking of Mobile Users. In *Proceedings of the ACM SIGCOMM Symposium on Communications, Architectures and Protocols*, pages 221–233, September 1991.

[5] Bharat Bhargava, Yinhe Jiang, and Jagannathan Srinivasan. O-Raid: Experiences and Experiments. In *International Conference on Intelligent and Cooperative Information Systems, Rotterdam, Holland*, May 1993.

[6] Bharat Bhargava and John Riedl. The Raid Distributed Database System. *IEEE Transaction on Software Engineering*, 15(6), June 1989.

[7] Panos K. Chrysanthis. Transaction Processing in Mobile Computing Environment. In *Proceedings of the IEEE Workshop on Advances in Parallel and Distributed Systems*, pages 77–83, Princeton, New Jersey, October 1993.

[8] Daniel Duchamp, Steven K. Feiner, Jr Gerald and Q. Maguire. Software Technology for Wireless Mobile Computing. *IEEE Network Magazine*, pages 12–18, November 1991.

[9] George H. Forman and John Zahorjan. The Challenges of Mobile Computing. *IEEE Computer*, 27(6), April 1994.

[10] Jim Gray and Andreas Reuter. *Transaction Processing: Concepts and Techniques*. Morgan Kaufmann, 1993.

[11] Object Management Group. The Common Object Request Broker: Architecture and Specification. OMG Document Number 91.12.1, December 1991.

[12] D. Hayden. The New Age of Wireless. *Mobile Office*, May 1992.

[13] Yixiu Huang, Prasad Sistla, and Ouri Wolfson. Data Replication for Mobile Computers. In *Proceeding of 1994 ACM SIGMOD*, May 1994.

[14] Tomasz Imielinksi and B. R. Badrinath. Data Management for Mobile Computing. *SIGMOD Record*, 22(1):34-39, March 1993.

[15] Tomasz Imielinksi and B. R. Badrinath. Wireless Mobile Computing: Challenges in Data Management. Technical Report DCS-TR-296 and WINLAB TR-49, Rutgers, Dept. of Comp. Sciences, 1993. To appear in Communications of the ACM, 1994.

[16] T. Imielinski and B. R. Badrinath. Querying in Highly Mobile Distributed Environments. In *Proceedings of 18th VLDB*, pages 41–52, August 1992.

[17] John Ioannidis, Dan Duchamp, Jr Gerald, and Q. Maguire. IP-based Protocols for Mobile Internetworking. In *Proceedings of the ACM SIGCOMM Symposium on Communications, Architectures and Protocols*, pages 235–245, September 1991.

[18] James J. Kistler and M. Satyanarayanan. Disconnected Operation in the Coda File System. *ACM Transactions on Computer Systems*, 10(1):3–25, February 1992.

[19] John R. Nicol, C. Thomas Wilkes, and Frank A. Manola. Object Orientation in Heterogeneous Distributed Computing Systems. *IEEE Computer*, 26(6): 57–67, June 1993.

[20] Evaggelia Pitoura and Bharat Bhargava. Dealing with Mobility: Issues and Research Challenges. Technical Report TR-93-070, Purdue University, Dept. of Comp. Sciences, 1993. Available through the WWW, http://www.cs.purdue.edu/people/pitoura.

[21] Evaggelia Pitoura and Bharat Bhargava. Maintaining Consistency of Data in Mobile Distributed Environments. Technical Report TR-94-025, Purdue University, Dept. of Comp. Sciences, 1994.

[22] Amit Sheth and Marek Rusinkiewicz. Management of Interdependent Data: Specifying Dependency and Consistency Requirements. In *Proceedings of the Workshop on the Management of Replicated Data*, pages 133–136, Houston, Texas, November 1990.

[23] Carl D. Tait and Dan Duchamp. Service Interface and Replica Management Algorithm for Mobile File System Clients. In *Proceedings of the First International Conference on Parallel and Distributed Information Systems*, pages 190–197, 1991.

[24] C.J. Taylor. A Status Report on Open Distributed Processing. *First Class (Object Management Group Newsletter)*, 2(2):11–13, June/July 1992.

[25] Fumio Teraoka, Yasuhiko Yokote, and Mario Tokoro. A Network Architecture Providing Host Migration Transparency. In *Proceedings of the ACM SIGCOMM Symposium on Communications, Architectures and Protocols*, pages 209–220, September 1991.

[26] Yongguang Zhang and Bharat Bhargava. Wance: A Wide Area Network Communication Emulation System. In *Proceedings of IEEE Workshop on Advances in Parallel and Distributed Systems*, pages 40–45, Princeton, NJ, October 1993.

Building information systems for mobile environments

Full text Pdf (908 KB)

Source **Conference on Information and Knowledge Management** archive
Proceedings of the third international conference on Information and knowledge management table of contents
Gaithersburg, Maryland, United States
Pages: 371 - 378
Year of Publication: 1994
ISBN:0-89791-674-3

Authors Evaggelia Pitoura Department of Computer Science, Purdue University, West Lafayette, IN
Bharat Bhargava Department of Computer Science Purdue University, West Lafayette, IN

Sponsors SIGIR: ACM Special Interest Group on Information Retrieval
NIST : National Institue of Standards & Technology
UMBC : U of MD Baltimore County
SIGART: ACM Special Interest Group on Artificial Intelligence

Publisher ACM Press New York, NY, USA

Additional Information: abstract references cited by index terms collaborative colleagues peer to peer

Tools and Actions: Find similar Articles Review this Article
Save this Article to a Binder Display Formats: BibTex EndNote ACM Ref

DOI Bookmark: Use this link to bookmark this Article: http://doi.acm.org/10.1145/191246.191310
What is a DOI?

↑ ABSTRACT

It is expected that in the near future, tens of millions of users will have access to distributed information systems through wireless connections. The technical characteristics of the wireless medium and the resulting mobility of both data resources and data consumers raise new challenging questions regarding the development of information systems appropriate for mobile environments. In this paper, we report on the development of such a system. First, we describe the general architecture of the information system and the main considerations of our design. Then, based on these considerations, we present our system support for maintaining the consistency of replicated data and for providing transaction schemas that account for the frequent but predictable disconnections, the mobility, and the vulnerability of the wireless environment.

↑ REFERENCES

Note: OCR errors may be found in this Reference List extracted from the full text article. ACM has opted to expose the complete List rather than only correct and linked references.

1 Rafael Alonso , Daniel Barbara , Hector Garcia-Molina, Data caching issues in an information retrieval system, ACM Transactions on Database Systems (TODS), v.15 n.3,

p.359-384, Sept. 1990 [doi>10.1145/88636.87848]

2 Rafael Alonso, Eben M. Haber, and Henry F. Korth. A Mobile Computer Interface for Heterogeneous Databases. In Proceedings of the RIDE-IMS'93 Workshop, Vienna, Austria, April 1993.

3 Rafael Alonso , Henry F. Korth, Database system issues in nomadic computing, Proceedings of the 1993 ACM SIGMOD international conference on Management of data, p.388-392, May 25-28, 1993, Washington, D.C., United States [doi>10.1145/170036.170092]

4 Baruch Awerbuch , David Peleg, Concurrent online tracking of mobile users, Proceedings of the conference on Communications architecture & protocols, p.221-233, September 03-06, 1991, Zurich, Switzerland [doi>10.1145/115992.116013]

5 Bharat Bhargava, Yinhe Jiang, and Jagannathan Srinivasan. O-Raid: Experiences and Experiments. In International Conference on Intelligent and Cooperative Information Systems, Rotterdam, Holland, May 1993.

6 Bharat Bhargava , John Riedl, The Raid Distributed Database System, IEEE Transactions on Software Engineering, v.15 n.6, p.726-736, June 1989 [doi>10.1109/32.24726]

7 Panos K. Chrysanthis. Transaction Processing in Mobile Computing Environment. In Proceedings ojf the IEEE Workshop on Advances in Parallel and Distributed Systems, pages 77-83, Princeton, New Jersey, October 1993.

8 Daniel Duchamp, Steven K. Feiner, Jr Gerald and Q. Maguire. Software Technology for Wireless Mobile Computing. IEEE Network Magazine, pages 12-18, November 1991.

9 George H. Forman , John Zahorjan, The Challenges of Mobile Computing, Computer, v.27 n.4, p.38-47, April 1994 [doi>10.1109/2.274999]

10 Jim Gray , Andreas Reuter, Transaction Processing: Concepts and Techniques, Morgan Kaufmann Publishers Inc., San Francisco, CA, 1992

11 Object Management Group. The Common Object Request Broker: Architecture and Specification. OMG Document Number 91.12.1, December 1991.

12 D. Hayden. The New Age of Wireless. Mobile Office, May 1992.

13 Yixiu Huang , Prasad Sistla , Ouri Wolfson, Data replication for mobile computers, Proceedings of the 1994 ACM SIGMOD international conference on Management of data, p.13-24, May 24-27, 1994, Minneapolis, Minnesota, United States [doi>10.1145/191839.191845]

14 Tomasz Imielinski , B. R. Badrinath, Data management for mobile computing, ACM SIGMOD Record, v.22 n.1, p.34-39, March 1993 [doi>10.1145/156883.156888]

15 Tomasz Imielinski , B. R. Badrinath, Mobile wireless computing: challenges in data management, Communications of the ACM, v.37 n.10, p.18-28, Oct. 1994 [doi>10.1145/194313.194317]

16 Tomasz Imielinski , B. R. Badrinath, Querying in Highly Mobile Distributed Environments, Proceedings of the 18th International Conference on Very Large Data Bases, p.41-52, August 23-27, 1992

17 John Ioannidis , Dan Duchamp , Gerald Q. Maguire, Jr., IP-based protocols for mobile internetworking, Proceedings of the conference on Communications architecture & protocols, p.235-245, September 03-06, 1991, Zurich, Switzerland [doi>10.1145/115992.116014]

18 James J. Kistler , M. Satyanarayanan, Disconnected operation in the Coda File System, ACM Transactions on Computer Systems (TOCS), v.10 n.1, p.3-25, Feb. 1992 [doi>10.1145/146941.146942]

19 John R. Nicol , C. Thomas Wilkes , Frank A. Manola, Object orientation in heterogeneous distributed computing systems, Computer, v.26 n.6, p.57-67, June 1993 [doi>10.1109/2.214434]

20 Evaggelia Pitoura and Bharat Bhargava. Dealing with Mobility: Issues and Research Challenges. Technical Report TR-93-070, Purdue University, Dept. of Corny. Sciences, 1993. Available through the WWW, http://www, cs.purdue, edu/people/pitour a.

21 Evaggelia Pitoura and Bharat Bhargava. Maintaining Consistency of Data in Mobile Distributed Environments. Technical Report TR-94-025, Purdue University, Dept. of Corny. Sciences, 1994.

22 Amit Sheth and Marek Rusinkiewicz. Management of Interdependent Data: Specifying Dependency and Consistency Requirements. In Proceedings of the Workshop on the Management of Replicated Data, pages 133-136, Houston, Texas, November 1990.

23 Carl D. Tait , Dan Duchamp, Service interface and replica management algorithm for mobile file system clients, Proceedings of the first international conference on Parallel and distributed information systems, p.190-197, December 1991, Miami, Florida, United States

24 C.J. Taylor. A Status Report on Open Distributed Processing. First Class (Object Management Group Newsletter), 2(2):11-13, June/July 1992.

25 Fumio Teraoka , Yasuhiko Yokore , Mario Tokoro, A network architecture providing host migration transparency, Proceedings of the conference on Communications architecture & protocols, p.209-220, September 03-06, 1991, Zurich, Switzerland [doi>10.1145/115994.116012]

26 Yongguang Zhang and Bharat Bhargava. Wance: A Wide Area Network Communication Emulation Systern. In Proceedings of IEEE Workshop on Advances #n Parallel and Distributed Systems, pages 40-45, Princeton, NJ, October 1993.

CITED BY *9*

I. Stanoi , D. Agrawal , A. El Abbadi , S. H. Phatak , B. R. Badrinath, Data warehousing alternatives for mobile environments, Proceedings of the 1st ACM international workshop on Data engineering for wireless and mobile access, p.110-115, August 20-20, 1999, Seattle, Washington, United States

Ayse Y. Seydim , Margaret H. Dunham , Vijay Kumar, Location dependent query processing, Proceedings of the 2nd ACM international workshop on Data engineering for wireless and mobile access, p.47-53, May 2001, Santa Barbara, California, United States

Shirish Hemant Phatak , B. R. Badrinath, Data partitioning for disconnected client server databases, Proceedings of the 1st ACM international workshop on Data engineering for wireless and mobile access, p.102-109, August 20-20, 1999, Seattle, Washington, United States

Shou-Chih Lo , Arbee L. P. Chen, An Adaptive Access Method for Broadcast Data under an Error-Prone Mobile Environment, IEEE Transactions on Knowledge and Data Engineering, v.12 n.4, p.609-620, July 2000

Victor C. S. Lee , Kwok Wa Lam , Tei-Wei Kuo, Efficient validation of mobile transactions in wireless environments, Journal of Systems and Software, v.69 n.1-2, p.183-193, 01 January 2004

Evaggelia Pitoura , Bharat Bhargava, Data Consistency in Intermittently Connected Distributed

Systems, IEEE Transactions on Knowledge and Data Engineering, v.11 n.6, p.896-915, November 1999

Sanjay Kumar Madria , Bharat Bhargava, A Transaction Model to Improve Data Availability in Mobile Computing, Distributed and Parallel Databases, v.10 n.2, p.127-160, September 2001

Raul Morales-Salcedo , Hiroaki Ogata , Yoneo Yano, Using RFID and dynamic metadata in an educational digital library, Proceedings of the 5th IASTED international conference on Web-based education, p.323-331, January 23-25, 2006, Puerto Vallarta, Mexico

Patricia Serrano-Alvarado , Claudia Roncancio , Michel Adiba, A Survey of Mobile Transactions, Distributed and Parallel Databases, v.16 n.2, p.193-230, September 2004

↑ INDEX TERMS

Primary Classification:
H. Information Systems
↪ **H.2** DATABASE MANAGEMENT

Additional Classification:
H. Information Systems
↪ **H.4** INFORMATION SYSTEMS APPLICATIONS

General Terms:
Design, Theory

Keywords:
consistency, information systems, mobile computing, new applications, transaction management

↑ Collaborative Colleagues:

Bharat Bhargava:

Melliyal Annamalai
Mikhail Atallah
Rajive Bagrodia
Anjali Bhargava
Sourav S. Bhowmick
Boyan Botev
Shirley Browne
Omran Bukhres
Elizabeth Chang
John Chuang
Il Young Chung
Prasun Dewan
Henry G. Dietz
John Dilley
Tharam S. Dillon
Gang Ding
Gang Ding
Sonia Fahmy
Tim Finin
Mario Gerla
Halima Ghafoor
Shalab Goel
Ahsan Habib
Md Ahsan Habib
Susanne Hambrusch
Mohamed Hefeeda
Abdelsalam Helal
Cecil T. Hua
Farookh Khadeer Hussain
Mamata Jenamani
Zhengrong Ji
Yin-He Jiang
Yin-he Jiang
Myong H. Kang
Vipul Kashyap
Maleq Khan
Stephen R. Kimbleton
Jiejun Kong
Pei-Jyun Leu
David Lewis
Shunge Li
Leszek Lilien
Barbara H. Liskov
John Lyon
Sanjay Kumar Madria
Enrique Mafla
S. N. Maheshwari
Malika Mahoui
Jack Minker
Don P. Moehrke
Mukesh Mohania
Biswanath Mukherjee
James G. Mullen
Wolfgang Nejdl
Peter Lei Ng
Marian Nodine
Daniel Olmedilla
Philip Orlik
Biswajit Panja
Evaggelia Pitoura
Bina Ramamurthy
John Riedl
Arnon Rosenthal
Zuwang Ruan
Morris Sloman
A. O. Smith
Jagannathan Srinivasan
Steffen Staab
Malik Ayed Tubaishat
J. D. Ullman
Shambhu Upadhyaya
Sheng-Yih Wang
Weichao Wang
Marianne Winslett
Xiaoxin Wu
Xiaoxin Wu
Xiaoxin Wu
Dongyan Xu
David K. Y. Yau
Yelena Yesha
Aidong Zhang
Jinyun Zhang
Youngguang Zhang

		Xiangning Liu Yi Lu Yi Lu	Zafer Sahinoglu Changgui Shi	Yuhui Zhong B. chandra
Evaggelia Pitoura:	Serge Abiteboul Melliyal Annamalai Sujata Banerjee Elisa Bertino Bharat Bhargava Bharat K. Bhargava Omran Bukhres Panos K. Chrysanthis Vassilios V. Dimakopoulos Ahmed Elmagarmid Ahmed K. Elmagarmid	Paraskevas Evripidou Elena Ferrari Ioannis Fudos Shalab Goel Arantza Illarramendi Alexandros Karakasidis Kyriakos Karenos Georgia Kastidou A. Kinalis Georgia Koloniari V. Kumar	Vijay Kumar Elias Leontiadis Shunge Li Sanjay Kumar Madria Christoforos Panayiotou Stavros Papastavrou Dieter Pfoser Krithi Ramamritham George Samaras Oleg Shigiltchoff Chara Skouteli	Constantinos Spyrou Wojciech Szpankowski Nectaria Tryfona Aphrodite Tsalgatidou I. Tsoulos Panos Vassiliadis Michalis Vazirgiannis Yolanda Villate Aidong Zhang Yongguang Zhang

↑ **Peer to Peer - Readers of this Article have also read:**

- M4: a metamodel for data preprocessing **Proceedings of the 4th ACM international workshop on Data warehousing and OLAP**
  Anca Vaduva , Jörg-Uwe Kietz , Regina Zücker

- Data structures for quadtree approximation and compression **Communications of the ACM** 28, 9
  Hanan Samet

- A hierarchical single-key-lock access control using the Chinese remainder theorem **Proceedings of the 1992 ACM/SIGAPP Symposium on Applied computing**
  Kim S. Lee , Huizhu Lu , D. D. Fisher

- The GemStone object database management system **Communications of the ACM** 34, 10
  Paul Butterworth , Allen Otis , Jacob Stein

- Putting innovation to work: adoption strategies for multimedia communication systems **Communications of the ACM** 34, 12
  Ellen Francik , Susan Ehrlich Rudman , Donna Cooper , Stephen Levine

Hit List

First Hit | Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Search Results - Record(s) 1 through 2 of 2 returned.

☐ 1. Document ID: US 5812776 A

L1: Entry 1 of 2 File: USPT Sep 22, 1998

US-PAT-NO: 5812776
DOCUMENT-IDENTIFIER: US 5812776 A

TITLE: Method of providing internet pages by mapping telephone number provided by client to URL and returning the same in a redirect command by server

DATE-ISSUED: September 22, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Gifford; David K.	Weston	MA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Open Market, Inc.	Burlington	MA			02

APPL-NO: 08/486797 [PALM]
DATE FILED: June 7, 1995

INT-CL-ISSUED: [06] G06F 15/16, G06F 15/82

INT-CL-CURRENT:

TYPE	IPC	DATE
CIPS	G06 F 17/30	20060101
CIPS	G06 F 1/00	20060101
CIPS	G06 F 21/00	20060101
CIPS	H04 L 29/06	20060101

US-CL-ISSUED: 395/200.47; 395/200.33, 395/200.48, 395/200.49
US-CL-CURRENT: 709/217; 709/203, 709/218, 709/219

FIELD-OF-CLASSIFICATION-SEARCH: 395/200, 395/600, 395/157, 395/200.01, 395/200.15, 395/200.47, 395/200.48, 395/200.49, 395/200.33, 364/280, 364/286, 370/392, 370/401, 370/405
See application file for complete search history.

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4941089	July 1990	Fischer	395/200.01
5204947	April 1993	Bernstein et al.	395/157
5297249	March 1994	Bernstein et al.	395/156
5309437	May 1994	Perlman et al.	370/401
5325362	June 1994	Aziz	370/405
5353283	October 1994	Tsuchiya	370/392
5483652	January 1996	Sudama et al.	395/600
5491820	February 1996	Belove et al.	395/600
5530852	June 1996	Meske, Jr. et al.	395/600
5544320	August 1996	Konrad	395/200.09
5577209	November 1996	Boyle et al.	395/200.06
5583996	December 1996	Tsuchiya	395/200.15

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	CLASS
0 456 920	November 1991	EP	
WO 94/03959	February 1994	WO	
WO 94/03859	February 1994	WO	
0 645 688	March 1995	WO	

OTHER PUBLICATIONS

Ramanathan, Srinivas, et al., "Architectures for Personalized Multimedia," IEEE Multimedia, vol. 1, No. 1, Computer Society, pp. 37-46, 1994.
Choudhury, Abhijit K., et al., "Copyright Protection for Electronic Publishing Over Computer Networks," IEEE Network, The Magazine of Computer Communications, vol. 9, No. 3, pp. 12-20, May 1995.
"maX.500--a Macintosh X.500 Directory Client", contents of WWW Web Site http://www.umich.edu/.about.rsug/ldap/max500/ as of Jul. 7, 1997, Sep. 6, 1995.
"Directory Server 1.0 for Windows NT and Unix", contents of WWW Web Site, http://www.merchant.netscape.com/netstore/servers/directory.html as of Jul. 7, 1997.
"X.500 Implementation Description Page", Contents of WWW Web Site, http://www.internic.net/projects/x500catalog/impdescrs/hpdistdir.html as of Jul. 7, 1997, Aug. 16, 1993.
"New host for internet commercial site index", Menefee, Craig, Newsbytes, Nov. 9, 1994, p. 15.
"Content in context: the future of SGML and HTML", Michalski, Jerry, Release 1.0, Sep. 27, 1994, EDventure Holdings Inc., V94, n9, p. 13.
"SuperHighway Acess eases Internet entry", Phillips, Ken, PC Week,V11, n43, Siff-Davis publishing Co., p. 3, Oct. 31, 1994.
"Wide area information servers", Buhle, Digital Systems Journal, Professional Press Inc., V16, n5, p. 13, Oct. 1994.
"Commercialization of the Internet opens gateway to Interpreneurs", Metcalfe, InfoWorld, InfoWorld publishing Co., v16, n32, p. 44, Aug. 8, 1994.
Netscape Products, "Open and Secure Internet Software" Internet, Sep. 18, 1995, pp. 1-2.
Merchant System: Overview, "Netscape Merchant System Data Sheet" Internet, Sep. 18, 1995, pp. 1-3.

Intenet Applications Customer Showcase, "Customer Showcase" Internet, Sep. 18, 1995., pp. 1-2.
The Server-Application Function and Netscape Server API, "The Netscape Server API" Netscape Products Internet, Sep. 18, 1995, pp. 1-11.
The Object-Oriented Paradigm of Server Configuration, "The Object-Oriented Pradigm of Server Configuration" Internet, Sep. 18, 1995, p. 102.
Verisign Redirection Information, "Important Announcement" Internet, Sep. 18, 1995, p. 1.
Lou Montulli, Electronic Mail to multiple recipients of the www-talk list (www-talk@www10.w3.org) on "Session Tracking" (omi.mail.www-talk, Apr. 18, 1995).
PR: Digital IDs for Open Market's Secure WebServer, "Press Release, VeriSign, Inc. to Provide Digital IDs for Open Market's Secure WebServer" Internet, Sep. 18, 1995, pp. 1-2.
PR: Online Security Solutions, "VeriSign, Inc. Adds the Missing Component to Online Security Solutions" Internet, Sep. 18, 1995, pp. 1-2.
The SSL Protocol, Internet, Sep. 18, 1995, pp. 1-18.
IStore, "Netscape Istore Data Sheet" Internet, Sep. 18, 1995, pp. 1-2.
Peterson, Larry L., "A Yellow-Pages Service for a Local-Area Network", ACM Proceedingsof the ACM SIGCOMM 87 Workshop, ACM Press, 1988, pp. 235-242.

ART-UNIT: 272

PRIMARY-EXAMINER: Lee; Thomas C.

ASSISTANT-EXAMINER: Kim; Ki S.

ATTY-AGENT-FIRM: Hamilton, Brook, Smith & Reynolds, P.C.

ABSTRACT:

This invention relates to methods for providing access to network servers. In particular, the process described in the invention includes client-server sessions over the Internet involving hypertext files. In the hypertext environment, a client views a document transmitted by a content server with a standard program known as the browser. Each hypertext document or page contains links to other hypertext pages which the user may select to traverse. The user may also access a hypertext page by providing a conventional telephone number or other descriptor. The server maps such a telephone number or descriptor to a target page identifier using a translation database and automatically directs the client to retrieve the desired page.

2 Claims, 7 Drawing figures

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw D

☐ 2. Document ID: JP 2006309753 A, WO 9642041 A2, AU 9659367 A, WO 9642041 A3, US 5708780 A, EP 830774 A2, AU 694367 B, US 5812776 A, JP 11507752 W, JP 2002157180 A, EP 830774 B1, DE 69633564 E, DE 69633564 T2, JP 3762882 B2, US 5708780 C1, JP 2006134319 A

L1: Entry 2 of 2 File: DWPI Nov 9, 2006

DERWENT-ACC-NO: 1997-065577
DERWENT-WEEK: 200675

TITLE: Client/server service request processing method for WWW - involves forwarding service request from client to server system which is returned with session identifier allowing access history monitoring

INVENTOR: GIFFORD, D K; LEVERGOOD, T M ; MORRIS, S J ; PAYNE, A C ; STEWART, L C ; TREESE, G W ; GIFFORD, K ; LEVERGOOD, M ; MORRIS, J ; PAYNE, C ; STEWART, C ; TREESE, W

PATENT-ASSIGNEE: OPEN MARKET INC (OPENN), DIVINE TECHNOLOGY VENTURES (DIVIN), D & I SYSTEMS KK (DISYN)

PRIORITY-DATA: 1995US-0486797 (June 7, 1995), 1995US-0474096 (June 7, 1995)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
JP 2006309753 A	November 9, 2006		051	G06F013/00
WO 9642041 A2	December 27, 1996	E	069	G06F000/00
AU 9659367 A	January 9, 1997		000	G06F019/00
WO 9642041 A3	March 13, 1997		000	G06F000/00
US 5708780 A	January 13, 1998		067	G06F015/56
EP 830774 A2	March 25, 1998	E	000	H04L029/06
AU 694367 B	July 16, 1998		000	G06F017/30
US 5812776 A	September 22, 1998		000	G06F015/16
JP 11507752 W	July 6, 1999		070	G06F015/00
JP 2002157180 A	May 31, 2002		044	G06F013/00
EP 830774 B1	October 6, 2004	E	000	H04L029/06
DE 69633564 E	November 11, 2004		000	H04L029/06
DE 69633564 T2	November 24, 2005		000	H04L029/06
JP 3762882 B2	April 5, 2006		047	G06F013/00
US 5708780 C1	April 4, 2006		000	G06F015/16
JP 2006134319 A	May 25, 2006		050	G06F021/00

DESIGNATED-STATES: AU CA DE GB IL JP AT BE CH DE DK ES FI FR GB GR IE IT LU MC NL PT SE AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE

CITED-DOCUMENTS:2.Jnl.Ref; EP 456920 ; EP 645688 ; WO 9403959

APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
JP2006309753A	June 3, 1996	1997JP-0503084	Div ex
JP2006309753A	April 11, 2006	2006JP-0108796	
WO 9642041A2	June 3, 1996	1996WO-US07838	
AU 9659367A	June 3, 1996	1996AU-0059367	
AU 9659367A		WO 9642041	Based on
WO 9642041A3	June 3, 1996	1996WO-US07838	
US 5708780A	June 7, 1995	1995US-0474096	
EP 830774A2	June 3, 1996	1996EP-0916695	
EP 830774A2	June 3, 1996	1996WO-US07838	

EP 830774A2		WO 9642041	Based on
AU 694367B	June 3, 1996	1996AU-0059367	
AU 694367B		AU 9659367	Previous Publ.
AU 694367B		WO 9642041	Based on
US 5812776A	June 7, 1995	1995US-0486797	
JP 11507752W	June 3, 1996	1996WO-US07838	
JP 11507752W	June 3, 1996	1997JP-0503084	
JP 11507752W		WO 9642041	Based on
JP2002157180A	June 3, 1996	1997JP-0503084	Div ex
JP2002157180A	June 3, 1996	2001JP-0208296	
EP 830774B1	June 3, 1996	1996EP-0916695	
EP 830774B1	June 3, 1996	1996WO-US07838	
EP 830774B1		WO 9642041	Based on
DE 69633564E	June 3, 1996	1996DE-0633564	
DE 69633564E	June 3, 1996	1996EP-0916695	
DE 69633564E	June 3, 1996	1996WO-US07838	
DE 69633564E		EP 830774	Based on
DE 69633564E		WO 9642041	Based on
DE 69633564T2	June 3, 1996	1996DE-0633564	
DE 69633564T2	June 3, 1996	1996EP-0916695	
DE 69633564T2	June 3, 1996	1996WO-US07838	
DE 69633564T2		EP 830774	Based on
DE 69633564T2		WO 9642041	Based on
JP 3762882B2	June 3, 1996	1997JP-0503084	Div ex
JP 3762882B2	July 9, 2001	2001JP-0208296	
JP 3762882B2		JP2002157180	Previous Publ.
US 5708780C1	June 7, 1995	1995US-0474096	
JP2006134319A	June 3, 1996	1997JP-0503084	Div ex
JP2006134319A	October 20, 2005	2005JP-0305380	

2006134319 A INT-CL (IPC): G06F 0/00; G06F 13/00; G06F 15/00; G06F 15/16; G06F 15/56; G06F 15/82; G06F 17/30; G06F 19/00; G06F 21/00; G06F 21/20; G09C 1/00; H04L 9/32; H04L 12/54; H04L 12/58; H04L 29/06; H04L 29/08; H04M 11/00

ABSTRACTED-PUB-NO: US 5708780A
BASIC-ABSTRACT:

The service request processing method involves forwarding a service request from a client to the server system. A session identifier is returned from the server system to the client. The session identifier is appended to the request and subsequent service requests from the client to the server system within a session of requests.

The server system tracks an access history of sequences of service requests within a session of requests to determine requests leading to a purchase made within the request session. The server system counts requests to particular services exclusive of repeated requests from a common client. A database of customer information is maintained containing access patterns and demographics.

ADVANTAGE - Allows client tracing. Provides security for private LANs.

ABSTRACTED-PUB-NO: US 5812776A
EQUIVALENT-ABSTRACTS:

The service request processing method involves forwarding a service request from a client to the server system. A session identifier is returned from the server system to the client. The session identifier is appended to the request and subsequent service requests from the client to the server system within a session of requests.

The server system tracks an access history of sequences of service requests within a session of requests to determine requests leading to a purchase made within the request session. The server system counts requests to particular services exclusive of repeated requests from a common client. A database of customer information is maintained containing access patterns and demographics.

ADVANTAGE - Allows client tracing. Provides security for private LANs.

The service request processing method involves forwarding a service request from a client to the server system. A session identifier is returned from the server system to the client. The session identifier is appended to the request and subsequent service requests from the client to the server system within a session of requests.

The server system tracks an access history of sequences of service requests within a session of requests to determine requests leading to a purchase made within the request session. The server system counts requests to particular services exclusive of repeated requests from a common client. A database of customer information is maintained containing access patterns and demographics.

ADVANTAGE - Allows client tracing. Provides security for private LANs.

WO 9642041A

CHOSEN-DRAWING: Dwg.2a/6 Dwg.3/6

DERWENT-CLASS: P85 T01
EPI-CODES: T01-H07C5A; T01-H07C5E; T01-S01B;

Terms	Documents
5812776.pn.	2

Hit List

First Hit | Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Search Results - Record(s) 1 through 2 of 2 returned.

1. Document ID: US 5805820 A

L2: Entry 1 of 2 File: USPT Sep 8, 1998

US-PAT-NO: 5805820
DOCUMENT-IDENTIFIER: US 5805820 A

TITLE: Method and apparatus for restricting access to private information in domain name systems by redirecting query requests

DATE-ISSUED: September 8, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Bellovin; Steven Michael	Westfield	NJ		
Cheswick; William Roberts	Bernardsville	NJ		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
AT&T Corp.	Middletown	NJ			02

APPL-NO: 08/679466 [PALM]
DATE FILED: July 15, 1996

INT-CL-ISSUED: [06] G06F 15/163

INT-CL-CURRENT:

TYPE	IPC	DATE
CIPS	H04 L 29/06	20060101
CIPS	H04 L 29/12	20060101

US-CL-ISSUED: 395/200.55; 707/9, 707/10, 395/187.01, 395/188.01, 395/200.59
US-CL-CURRENT: 709/225; 707/10, 707/9, 709/229, 726/12

FIELD-OF-CLASSIFICATION-SEARCH: 707/9, 707/10, 395/187.01, 395/188.01, 395/200.33, 395/200.48, 395/200.55, 395/200.59
See application file for complete search history.

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
5204961	April 1993	Barlow	395/725
5416842	May 1995	Aziz	380/30
5519858	May 1996	Walton et al.	395/600
5548649	August 1996	Jacobson	380/49
5550984	August 1996	Gelb	395/200.17
5586260	December 1996	Hu	395/200.2
5606668	February 1997	Schwed	395/200.11
5614927	March 1997	Gifford et al.	707/101
5623601	April 1997	Vu	395/187.01
5655077	August 1997	Jones et al.	395/187.01
5664185	September 1997	Landfield et al.	707/104

OTHER PUBLICATIONS

Greenwald et al., "designing an academic firewall: policy, practice, and experience with SURF", Network and Distributed system security symposium, IEEE, pp. 79-92, 1996.

ART-UNIT: 271

PRIMARY-EXAMINER: Black; Thomas G.

ASSISTANT-EXAMINER: Homere; Jean R.

ABSTRACT:

A device and method redirect query requests to restrict access to private information of a domain in a domain name system. The device includes a switching device that redirects query requests for the private information from within the domain to a device within the domain. The private information includes IP addresses and domain names. All the devices in the domain may be modified to direct all query requests to the switching device or the switching device may be incorporated into a firewall of the domain.

20 Claims, 13 Drawing figures

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

---

2. Document ID: JP 2006262532 A, EP 820176 A2, JP 10111848 A, US 5805820 A, CA 2209611 A, CA 2209648 A, US 5958052 A, MX 9705262 A1, CA 2209648 C, CA 2209611 C, MX 204786 B, MX 207768 B, EP 820176 B1, DE 69734179 E, DE 69734179 T2

L2: Entry 2 of 2 File: DWPI Sep 28, 2006

DERWENT-ACC-NO: 1998-079181
DERWENT-WEEK: 200664

TITLE: Information filtering subsystem for domain name system - filters information from first device of first domain and generates filtered information by removing

private information and forwarding this filtered information to second device of second domain

INVENTOR: BELLOVIN, S M; CHESWICK, W R

PATENT-ASSIGNEE: AT & T CORP (AMTT), AMERICAN TELEPHONE & TELEGRAPH CO (AMTT)

PRIORITY-DATA: 1996US-0683019 (July 16, 1996), 1996US-0679466 (July 15, 1996)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
JP 2006262532 A	September 28, 2006		017	H04L012/66
EP 820176 A2	January 21, 1998	E	019	H04L029/06
JP 10111848 A	April 28, 1998		017	G06F013/00
US 5805820 A	September 8, 1998		000	G06F015/163
CA 2209611 A	January 15, 1998		000	G06F012/14
CA 2209648 A	January 16, 1998		000	G06F012/14
US 5958052 A	September 28, 1999		000	G06F011/00
MX 9705262 A1	September 1, 1998		000	G06F009/00
CA 2209648 C	January 4, 2000	E	000	G06F012/14
CA 2209611 C	April 11, 2000	E	000	G06F012/14
MX 204786 B	October 18, 2001		000	G06F009/00
MX 207768 B	May 10, 2002		000	G06F009/00
EP 820176 B1	September 14, 2005	E	000	H04L029/06
DE 69734179 E	October 20, 2005		000	H04L029/06
DE 69734179 T2	June 29, 2006		000	H04L029/06

DESIGNATED-STATES: AL AT BE CH DE DK ES FI FR GB GR IE IT LI LT LU LV MC NL PT RO SE SI DE FR GB

APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
JP2006262532A	July 15, 1997	1997JP-0189349	Div ex
JP2006262532A	June 5, 2006	2006JP-0155655	
EP 820176A2	July 8, 1997	1997EP-0304969	
JP 10111848A	July 15, 1997	1997JP-0189349	
US 5805820A	July 15, 1996	1996US-0679466	
CA 2209611A	July 3, 1997	1997CA-2209611	
CA 2209648A	July 3, 1997	1997CA-2209648	
US 5958052A	July 15, 1996	1996US-0679466	Cont of
US 5958052A	July 16, 1996	1996US-0683019	
US 5958052A		US 5805820	Cont of
MX 9705262A1	July 11, 1997	1997MX-0005262	
CA 2209648C	July 3, 1997	1997CA-2209648	
CA 2209611C	July 3, 1997	1997CA-2209611	
MX 204786B	July 11, 1997	1997MX-0005260	
MX 207768B	July 11, 1997	1997MX-0005262	
EP 820176B1	July 8, 1997	1997EP-0304969	
DE 69734179E	July 8, 1997	1997DE-0634179	

DE 69734179E	July 8, 1997	1997EP-0304969	
DE 69734179E		EP 820176	Based on
DE 69734179T2	July 8, 1997	1997DE-0634179	
DE 69734179T2	July 8, 1997	1997EP-0304969	
DE 69734179T2		EP 820176	Based on

INT-CL (IPC): G06F 9/00; G06F 11/00; G06F 12/14; G06F 13/00; G06F 13/14; G06F 15/163; G06K 9/00; H04L 12/28; H04L 12/56; H04L 12/66; H04L 29/06; H04L 29/12

RELATED-ACC-NO: 1998-180890

ABSTRACTED-PUB-NO: EP 820176A
BASIC-ABSTRACT:

The subsystem includes a filtering device that receives information (520) from a first device of a first domain destined to a second device of a second domain. The filtering device generates filtered information (522) by removing private information of the second domain from the information and forwarding the filtered information to the second device of the second domain.

Preferably the private information of the second domain includes at least one of a domain name and an IP address of a device of the second domain. Preferably the information is sent by the first device in response to a query request by the second device. The information includes additional information that was not requested by the second device and which is filtered out before delivery to the second device.

USE - E.g. for restricting access to private information in domain name systems.

ADVANTAGE - Removes any possibility for device within domain to receive private information from device external to domain.

ABSTRACTED-PUB-NO: US 5805820A
EQUIVALENT-ABSTRACTS:

The subsystem includes a filtering device that receives information (520) from a first device of a first domain destined to a second device of a second domain. The filtering device generates filtered information (522) by removing private information of the second domain from the information and forwarding the filtered information to the second device of the second domain.

Preferably the private information of the second domain includes at least one of a domain name and an IP address of a device of the second domain. Preferably the information is sent by the first device in response to a query request by the second device. The information includes additional information that was not requested by the second device and which is filtered out before delivery to the second device.

USE - E.g. for restricting access to private information in domain name systems.

ADVANTAGE - Removes any possibility for device within domain to receive private information from device external to domain.

US 5958052A

The subsystem includes a filtering device that receives information (520) from a first device of a first domain destined to a second device of a second domain. The filtering device generates filtered information (522) by removing private information of the second domain from the information and forwarding the filtered information to the second device of the second domain.

Preferably the private information of the second domain includes at least one of a domain name and an IP address of a device of the second domain. Preferably the information is sent by the first device in response to a query request by the second device. The information includes additional information that was not requested by the second device and which is filtered out before delivery to the second device.

USE - E.g. for restricting access to private information in domain name systems.

ADVANTAGE - Removes any possibility for device within domain to receive private information from device external to domain.

DERWENT-CLASS: W01
EPI-CODES: W01-A07G;

Terms	Documents
5805820.pn.	2

Hit List

First Hit | Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Search Results - Record(s) 1 through 2 of 2 returned.

1. Document ID: US 5748954 A

L3: Entry 1 of 2 File: USPT May 5, 1998

US-PAT-NO: 5748954
DOCUMENT-IDENTIFIER: US 5748954 A

TITLE: Method for searching a queued and ranked constructed catalog of files stored on a network

DATE-ISSUED: May 5, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Mauldin; Michael L.	Penn Hills	PA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Carnegie Mellon University	Pittsburgh	PA			02

APPL-NO: 08/462520 [PALM]
DATE FILED: June 5, 1995

INT-CL-ISSUED: [06] G06F 17/30

INT-CL-CURRENT:

TYPE	IPC	DATE
CIPP	G06 F 17/30	20060101

US-CL-ISSUED: 395/610; 395/611
US-CL-CURRENT: 707/10; 707/100

FIELD-OF-CLASSIFICATION-SEARCH: 395/600, 395/601, 395/616, 395/610, 395/611
See application file for complete search history.

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4713754	December 1987	Agrawal et al.	364/200

5408655	April 1995	Oren et al.	395/600
5446740	August 1995	Yien et al.	370/110.1
5446891	August 1995	Kaplan et al.	395/600
5488725	January 1996	Turtle et al.	395/600
5495607	February 1996	Pisello et al.	395/600
5530852	June 1996	Meske, Jr. et al.	395/600

OTHER PUBLICATIONS

Loke et al, Compound Document Processing System, IEEE, pp. 640-644 Jan. 1991.
Li et al, Internet Resource Discovery Services, IEEE, pp. 8-22 Jan. 1993.
Mauldin et al, Web Agent Related Research at the Center for Machine Translation, To be presented at the SIGNIDR meeting, pp. 1-6 Aug. 1994.
Pinkerton, Finding What People Want: Experinces with the Web Crawler, The Sesign of the WebCrawler, pp. 1-10 Jan. 1994.
Bowman et al, Harvest: A Scalable, Customizable Discovery and Access System, Technical Report CU-CS 7329-94, pp. 1-27, Aug. 1994.
New Spiders Roam the Web, Computer-Mediated Communication Mazagine, vol. 1, No. 5, Sep. 1, 1994, p. 3, John December.
Web Agent Related Research at the center for Machine Translation, To be presented at the SIGNIDR meeting Aug. 4, 1994 in McLean, Michael L. Mauldin, John R. R. Leavitt.

ART-UNIT: 237

PRIMARY-EXAMINER: Black; Thomas G.

ASSISTANT-EXAMINER: Coby; Frantz

ATTY-AGENT-FIRM: Kirkpatrick & Lockhart LLP

ABSTRACT:

A method of constructing a catalog of files stored on a network comprised of a plurality of interconnected computers each having a plurality of files stored thereon. The method is accomplished by establishing a queue containing at least one address representative of a file stored on one of the interconnected computers, ranking each address in the queue according to the popularity of the file presented by the address, downloading the file corresponding to the address in the queue having the highest ranking, processing the downloaded file to generate certain information about the downloaded file for the catalog, adding to the queue any addresses found in the downloaded file, and determining the popularity of file represented by the addresses in the queue according to how often a file is referenced by a computer other than the computer on which the file is stored.

38 Claims, 13 Drawing figures

☐ 2. Document ID: US 5748954 A

L3: Entry 2 of 2 File: DWPI May 5, 1998

DERWENT-ACC-NO: 1998-286281
DERWENT-WEEK: 200353

TITLE: Distributed file storage catalog construction for internet - involves ranking stored file queue according to heuristic and popping file at top of queue for download and file information generation for catalog

INVENTOR: MAULDIN, M L

PATENT-ASSIGNEE: UNIV CARNEGIE MELLON (UYCAN)

PRIORITY-DATA: 1995US-0462520 (June 5, 1995)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
US 5748954 A	May 5, 1998		016	G06F017/30

APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
US 5748954A	June 5, 1995	1995US-0462520	

INT-CL (IPC): G06F 17/30

RELATED-ACC-NO: 2003-566758

ABSTRACTED-PUB-NO: US 5748954A
BASIC-ABSTRACT:

The catalog construction method involves establishing a queue containing at least one address representative of a file stored on one of the interconnected computers. Each address in the queue is ranked according to a heuristic. The file corresponding to the address in the queue having the highest ranking is downloaded. The downloaded file is processed to generate certain information about the downloaded file for the catalog. Any addresses found in the downloaded file are added to the queue.

This process is repeated. Address ranking includes ranking each address according to the popularity of the file represented by that address. The downloaded file processing includes storing link text, and merging the link text to generate information about files referenced in the downloaded files for the catalog.

ADVANTAGE - Provides accurate file search results. Processes information in meaningful manner.

ABSTRACTED-PUB-NO: US 5748954A
EQUIVALENT-ABSTRACTS:

CHOSEN-DRAWING: Dwg.6/10

DERWENT-CLASS: T01 W01
EPI-CODES: T01-J05B2B; T01-J05B3; W01-A06B7;

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Terms	Documents
5748954.pn.	2

Display Format: - Change Format

Previous Page Next Page Go to Doc#

Hit List

First Hit | Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Search Results - Record(s) 1 through 2 of 2 returned.

☐ 1. Document ID: US 5721832 A

L7: Entry 1 of 2 File: USPT Feb 24, 1998

US-PAT-NO: 5721832
DOCUMENT-IDENTIFIER: US 5721832 A

TITLE: Method and apparatus for an interactive computerized catalog system

DATE-ISSUED: February 24, 1998

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Westrope; Robert John	Toronto			CA
Martin; Bruce Edward	Mississauga			CA
Lyons; John Bernard	Richmond Hill			CA

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Regal Greetings & Gifts Inc.	Toronto			CA	03

APPL-NO: 08/439595 [PALM]
DATE FILED: May 12, 1995

INT-CL-ISSUED: [06] H01J 13/00

INT-CL-CURRENT:

TYPE	IPC	DATE
CIPS	G06 Q 30/00	20060101
CIPS	H04 M 3/487	20060101
CIPS	H04 M 3/493	20060101

US-CL-ISSUED: 395/227; 395/210, 348/13, 379/92, 235/383
US-CL-CURRENT: 705/27; 235/383, 379/93.12, 705/10, 725/60, 725/9

FIELD-OF-CLASSIFICATION-SEARCH: 346/401, 346/403, 346/406, 380/25, 235/383, 235/385, 235/375, 235/380, 395/227, 395/210, 348/13, 348/55, 379/92
See application file for complete search history.

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
Re30773	October 1981	Glaser et al.	235/379
Re31951	July 1985	Johnson	369/900
4584604	April 1986	Nakagawa	348/55
4603232	July 1986	Kurland	379/92
4792849	December 1988	McCalley et al.	358/86
4816904	March 1989	McKenna	395/13
4972504	November 1990	Daniel	395/210
5053956	October 1991	Donald	364/403
5088586	February 1992	Isobe	364/403
5195130	March 1993	Weiss et al.	379/98
5253341	October 1993	Rozmanith et al.	395/200
5315504	May 1994	Lemble	364/400
5315508	May 1994	Bain et al.	364/401
5451998	September 1995	Hamkick	364/403
5475585	December 1995	Bush	364/403
5528490	June 1996	Hill	364/403

OTHER PUBLICATIONS

"Electronic Shopping, Computer Catalogs"; Popular Science Jul. 1994, p. 41.

ART-UNIT: 267

PRIMARY-EXAMINER: Mullen; Thomas

ASSISTANT-EXAMINER: Wong; Albert K.

ATTY-AGENT-FIRM: Rader Fishman & Grauer PLLC

ABSTRACT:

The present invention relates to an improved method and apparatus for an interactive, computerized catalog system in which a customer can selectively access video and audio catalog data from a computerized catalog memory that permits a customer to peruse an entire catalog of products or services or select specific portions from specific catalogs or services and if desired place an order which is processed electronically and from which customer profile marketing data is selectively generated.

10 Claims, 8 Drawing figures

Full	Title	Citation	Front	Review	Classification	Date	Reference			Claims	KMC	Draw D

---

2. Document ID: CA 2176297 A, US 5968110 A, US 5721832 A

L7: Entry 2 of 2 File: DWPI Nov 13, 1996

DERWENT-ACC-NO: 1997-333185

DERWENT-WEEK: 199950

TITLE: Interactive computerised catalogue system - initiating order processing sequence and payment to permit user to enter product order from telephone and enabling user to be included in customer profile marketing file created from catalogue product order transactions

INVENTOR: LYONS, J B; MARTIN, B E ; WESTROPE, R J

PATENT-ASSIGNEE: REGAL GREETING & GIFTS INC (REGAN), REGAL GREETINGS & GIFTS INC (REGAN), HARDWARE STREET INC (HARDN)

PRIORITY-DATA: 1995US-0439595 (May 12, 1995), 1997US-0936245 (September 24, 1997)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
CA 2176297 A	November 13, 1996		038	H04M011/08
US 5968110 A	October 19, 1999		000	E01B015/00
US 5721832 A	February 24, 1998		012	H01J013/00

APPLICATION-DATA:

PUB-NO	APPL-DATE	APPL-NO	DESCRIPTOR
CA 2176297A	May 10, 1996	1996CA-2176297	
US 5968110A	May 12, 1995	1995US-0439595	Cont of
US 5968110A	September 24, 1997	1997US-0936245	
US 5968110A		US 5721832	Cont of
US 5721832A	May 12, 1995	1995US-0439595	

INT-CL (IPC): E01B 15/00; G06F 17/60; H01J 13/00; H04M 11/08

ABSTRACTED-PUB-NO: CA 2176297A
BASIC-ABSTRACT:

The interactive computerised catalogue process comprises storing digitised graphic catalogue data in an addressable computer system memory. A menu index of catalogue products and services comprising the catalog data available is generated for selective viewing at any user's telephone terminal screen.

A communication link is established between a user's telephone terminal and the computer system memory. The menu of catalogue products and services data to a user's telephone terminal is transmitted in response to a user's initial request. The catalogue data which corresponds to the user's product request signal is transmitted from the computer system memory.

An order processing sequence, including a financial payment authorisation process, is initiated to permit a user to enter, from a user telephone terminal, a product order to be processed and delivered in response to the user's order.

A user is enabled when placing an order to elect to be included in or to be excluded from a customer profile marketing data file created from completed catalogue product order transactions.

ADVANTAGE - Efficient product and service selectivity to prospective customers and

which selectively generate market profile data of users and customers.

ABSTRACTED-PUB-NO: US 5721832A
EQUIVALENT-ABSTRACTS:

The interactive computerised catalogue process comprises storing digitised graphic catalogue data in an addressable computer system memory. A menu index of catalogue products and services comprising the catalog data available is generated for selective viewing at any user's telephone terminal screen.

A communication link is established between a user's telephone terminal and the computer system memory. The menu of catalogue products and services data to a user's telephone terminal is transmitted in response to a user's initial request. The catalogue data which corresponds to the user's product request signal is transmitted from the computer system memory.

An order processing sequence, including a financial payment authorisation process, is initiated to permit a user to enter, from a user telephone terminal, a product order to be processed and delivered in response to the user's order.

A user is enabled when placing an order to elect to be included in or to be excluded from a customer profile marketing data file created from completed catalogue product order transactions.

ADVANTAGE - Efficient product and service selectivity to prospective customers and which selectively generate market profile data of users and customers.

US 5968110A

The interactive computerised catalogue process comprises storing digitised graphic catalogue data in an addressable computer system memory. A menu index of catalogue products and services comprising the catalog data available is generated for selective viewing at any user's telephone terminal screen.

A communication link is established between a user's telephone terminal and the computer system memory. The menu of catalogue products and services data to a user's telephone terminal is transmitted in response to a user's initial request. The catalogue data which corresponds to the user's product request signal is transmitted from the computer system memory.

An order processing sequence, including a financial payment authorisation process, is initiated to permit a user to enter, from a user telephone terminal, a product order to be processed and delivered in response to the user's order.

A user is enabled when placing an order to elect to be included in or to be excluded from a customer profile marketing data file created from completed catalogue product order transactions.

ADVANTAGE - Efficient product and service selectivity to prospective customers and which selectively generate market profile data of users and customers.

CHOSEN-DRAWING: Dwg.1/8 Dwg.6/8

DERWENT-CLASS: Q41 T01 W01
EPI-CODES: T01-J05A; W01-C05B3C; W01-C05B5C;

Full | Title | Citation | Front | Review | Classification | Date | Reference | | | Claims | KWIC | Draw De

Clear | Generate Collection | Print | Fwd Refs | Bkwd Refs | Generate OACS

Terms	Documents
5721832.pn.	2

Display Format: - Change Format

Previous Page Next Page Go to Doc#